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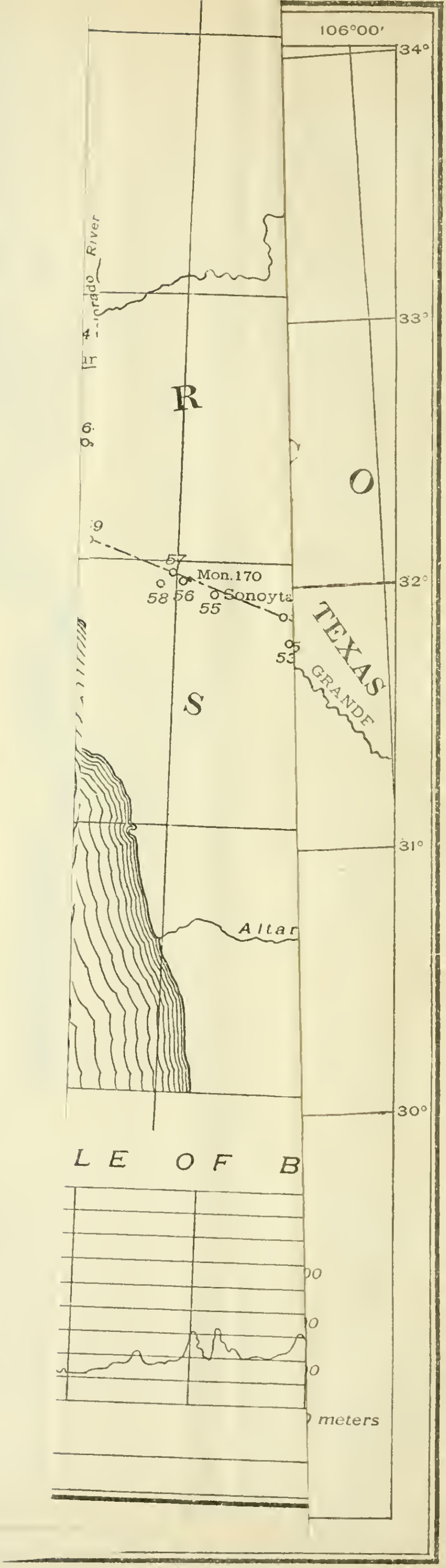
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SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
Bulletin 56

MAMMALS OF THE MEXICAN BOUNDARY OF THE UNITED STATES

A DESCRIPTIVE CATALOGUE OF THE SPECIES OF MAMMALS OCCURRING IN THAT REGION; WITH A GENERAL SUMMARY OF THE NATURAL HISTORY, AND A LIST OF TREES

BY

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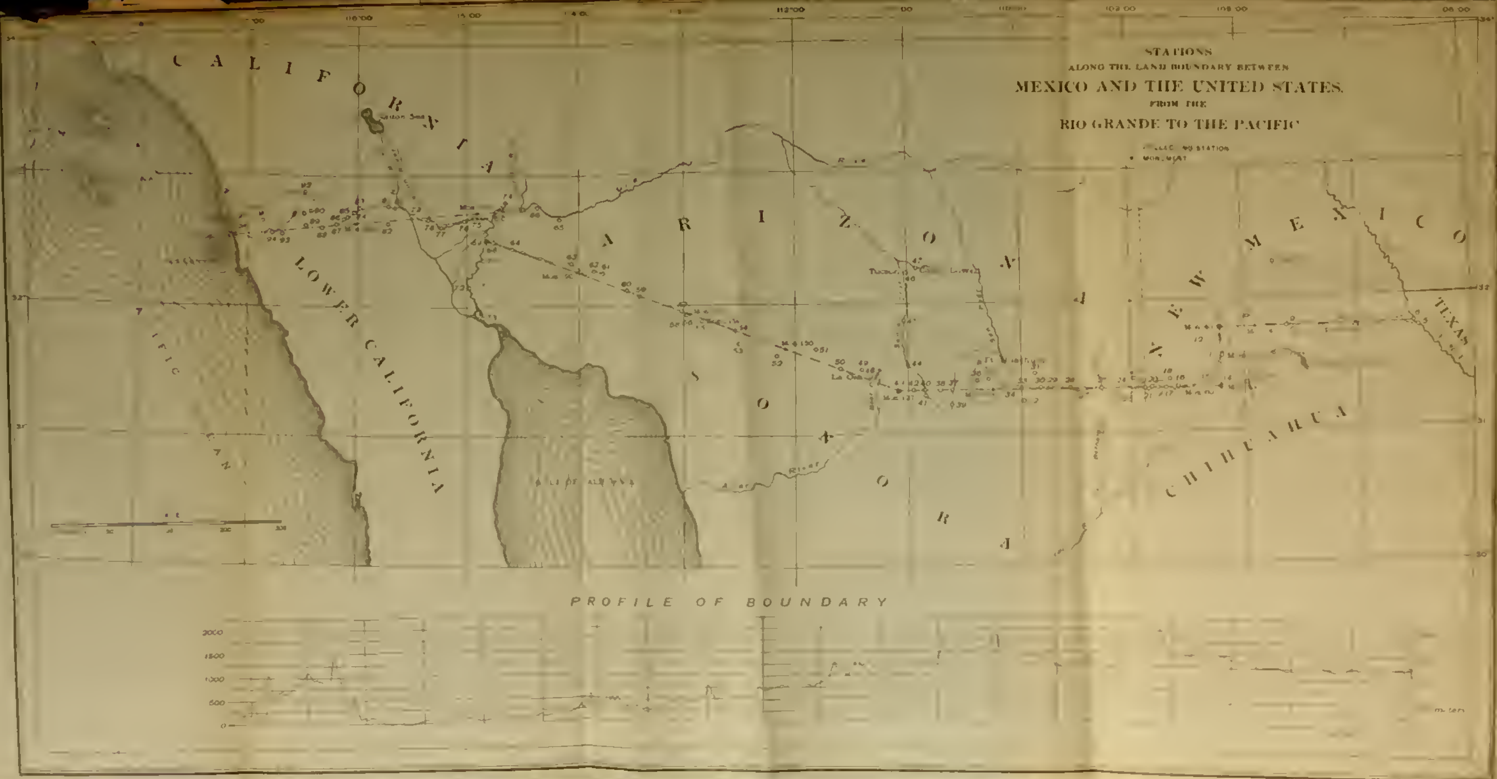
PART I

Families Didelphiidæ to Muridæ

WASHINGTON
GOVERNMENT PRINTING OFFICE
1907



STATIONS
ALONG THE LAND BOUNDARY BETWEEN
MEXICO AND THE UNITED STATES.
FROM THE
RIO GRANDE TO THE PACIFIC

STATION
MONUMENT
CALIFORNIA
ARIZONA
NEW MEXICO
TEXAS
LOWER CALIFORNIA
SONORA
CHIHUAHUA
Salton Sea
Tucson
PROFILE OF BOUNDARY
2000
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meters

Published April 13, 1907.

ADVERTISEMENT.

The scientific publications of the National Museum consist of two series—the *Bulletin* and the *Proceedings*.

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This work forms No. 56 of the *Bulletin* series.

Since 1902 the volumes of the series known as *Contributions from the National Herbarium*, and containing papers relating to the botanical collections of the Museum, have been published as bulletins.

The *Proceedings*, the first volume of which was issued in 1878, are intended as a medium of publication of brief original papers based on the collections of the National Museum, and setting forth newly acquired facts in biology, anthropology, and geology derived therefrom, or containing descriptions of new forms and revisions of limited groups. A volume is issued annually, or oftener, for distribution to libraries and scientific establishments, and in view of the importance of the more prompt dissemination of new facts a limited edition of each paper is printed in pamphlet form in advance.

Charles D. Walcott,
Secretary of the Smithsonian Institution.

Washington, U. S. A., *March 15, 1907.*

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MAMMALS OF THE MEXICAN BOUNDARY OF THE UNITED STATES.

By Edgar Alexander Mearns,
Major and Surgeon, U. S. Army.

GENERAL INTRODUCTION.

ORGANIZATION OF THE INTERNATIONAL BOUNDARY COMMISSION.

Under the provisions of the convention of July 29, 1882, revised by that of February 18, 1889, between the United States and Mexico, providing for an International Boundary Survey to re-locate the existing frontier line between the two countries west of the Rio Grande, the President of the United States directed the appointment of Lieut. Col. J. W. Barlow, Corps of Engineers; First Lieut. David D. Gaillard, Corps of Engineers; and Mr. A. T. Mosman, assistant, United States Coast and Geodetic Survey, members of a commission, who, with corresponding appointees of the Mexican Government, should form an International Boundary Commission to carry into effect the provisions of those conventions. Señor Don Jacobo Blanco, engineer in chief, and Señores Felipe Valle and José Tamborrel, associate engineers, were appointed on the part of Mexico, but they subsequently withdrew from the Commission and their places were filled by the appointment of Señores Valentin Gama and Guillermo B. y Puga. The first meeting, all of the members being present, was held at the Mexican custom-house in Juarez on November 17, 1891, when the International Boundary Commission came into formal existence. Complete organization of the personnel, transportation, and camp equipage of the surveying parties was effected subsequently.

The Mexican and American parties had separate organizations and worked independently in the field, though frequently passing one another or camping in juxtaposition. On taking the field at El Paso, Texas, in February, 1892, the United States party consisted of the three commissioners and about 60 civilian employees, with a transportation outfit of seven 4-mule baggage wagons, three 6-mule water-tank wagons, three 2-mule light spring wagons, one 2-mule buckboard, one 4-mule ambulance, 25 mules for packing, 83 mules in all, and 14 saddle ponies. Various changes in the personnel and transportation facilities occurred subsequently. In addition, the commission was provided, by direction of the War Department, with a military escort to accompany the expedition as a protection against Indians or other marauders. The military escort consisted of detachments of infantry for camp and guard duty, cavalry for patrol, courier and mail service, and a detachment of the Hospital Corps, accompanied by a Red Cross ambulance for the care and transportation of the sick. The soldiers were provided with the usual army facilities for transportation, including water wagons. Beginning with 50 enlisted men, in January, 1892, the number of soldiers was increased to 88 in November, 1892, and afterwards gradually reduced to 13, in August, 1894.

To carry out the work of the American commission conveniently, the whole force was subdivided as follows: (1) A main supply camp, with the commissioners and field office, hospital, draftsmen and field maps, photographer, and head mechanics, such as blacksmith, wheelwright, masons, and carpenters, together with the greater part of the military escort; (2) an astronomical party, for determining latitude and azimuth; (3) a tangent party, for running the tangents; (4) a topographical party, and (5), lastly, a Monument-Building Party, which was not organized until August 6, 1892, but remained in the field until the last monument was set up on the edge of the Pacific Ocean, on October 3, 1894, several months after the remaining parties had completed their operations and disbanded.

ESTABLISHMENT OF THE BIOLOGICAL SECTION OF THE SURVEY.

I was detailed by the War Department to act as medical officer of the Commission, and reported for duty as such at El Paso, Texas, on February 1, 1892. By previous correspondence with Lieut. Col. J. W. Barlow, senior commissioner, I had obtained authority to establish a biological section of the survey, provided this could be accomplished without additional cost to the appropriation allotted to the International Boundary Commission. This was effected through the cooperation of the United States National Museum, with the friendly assistance of the War and State Departments. No special appropriation was at any time made by the United States Government for the prosecution of biological research or the publication of reports on the collections made by the International Boundary Commission.

My services with the Commission extended from January, 1892, to September, 1894, excepting a few months, during which I was assigned to duty at Fort Clark, Texas. This interruption did not, however, prevent me from covering the entire Boundary Line, as I was able, by joining the monument party at a later period, to take up biological work at the exact point where it had been left on my departure for Fort Clark. My investigations along the whole line were therefore continuous.

The scientific work accomplished was of the nature of a biological survey of the Mexican Boundary region, and agrees essentially with the plan which I submitted to the Commission in January, 1892, before entering the field. Plants, vertebrate animals, mollusks, crustaceans, rocks, minerals, fossils, and a small amount of archeological and miscellaneous material were embraced in the collections, which were deposited in the United States National Museum.

About 100 collecting stations were occupied during the course of the survey, which extended over a period of nearly three years and covered an extent of 700 miles of the Boundary. I had been stationed at three military posts on the Rio Grande in Texas, and previously served for more than four years in the Territories of Arizona and New Mexico. At each of these posts, as well as at each of the collecting stations on the Boundary Line, an effort was made to procure and preserve specimens of each vertebrate animal and flowering plant that could be found, in order that the collections might furnish indisputable evidence of the longitudinal dispersal and variation of as many species as possible.

It seemed important that the exceptional facilities afforded by this survey for studying the degree and manner in which plants and animals vary along a parallel, and if possible the laws which govern such variations, should be utilized as fully as possible. To this end much time was devoted to gathering abundant material to show the distribution and variation with locality, of the several species. The longitudinal ranges of the species and subspecies (geographic races) were carefully defined, and an approximately accurate knowledge of the character and extent of the faunal and floral tracts crossed by the Boundary Line was obtained.

The collections were made by myself, with the occasional voluntary assistance of other members of the party and of Mr. Frank X. Holzner, a collector employed at my request by the United States National Museum and the American Museum of Natural History in New York. About 30,000 specimens were forwarded to the National Museum and distributed to specialists in the several departments represented, for the purpose of detailed elaboration. A report upon the Mollusca, with illustrations, by Dr. W. H. Dall and Mr. Charles T. Simpson (genera *Unio* and *Anodonta*), has been published.[a] Dr. Edwin C. E. Lord has published a Petrographic Report on Rocks from the United States-Mexico Boundary.[a] More or less progress has been made upon the other groups, and several preliminary papers containing descriptions of species new to science and based upon such material have been published.

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[a] Report on the mollusks collected by the International Boundary Commission pp. 333–379, pls. XXXI–XXXIII. (See also Nautilus, VI, April, 1893, p. 134, and Proc. U. S. Nat. Mus., XVII, 1895, pp. 1–6.)

The Biological Section, because in charge of the medical officer, was usually attached to the main or headquarters-camp, though every possible latitude was allowed by the commissioners for the furtherance of field work in zoology and botany.

The health of the party was excellent. With the exception of a soldier who died on duty, suffering from a chronic, though unsuspected disease, no lives were lost. A plucky recruit of the Second Cavalry was shot while carrying the mail, by a desperate outlaw, but he recovered quickly. Others of the party received gunshot wounds resulting from the careless use of firearms, and others again, especially members of the topographical party, were injured by falls while climbing among the rocks and cliffs of an exceedingly rough and broken country. When camped beside streams, a few members of the party, including myself and Mr. Holzner, my assistant, contracted malarial fevers. While at San Bernardino Spring (Monument No. 77), on the headwaters of the Yaqui, I was prostrated by æstivo-autumnal malaria fever. Previous to this attack I had arranged for a trip down the San Bernardino and Yaqui rivers into the country of the Yaqui Indians of Sonora, but malarial sickness compelled me to move to a dry camp for the purpose of recuperation, after exhausting the natural products of this semiaquatic collecting ground, in which glimpses of the novelties in the plant and animal kingdoms to be expected in the lower portions of the Yaqui were obtained. To this day the northern part of the Yaqui Basin remains the principal *terra incognita* of Mexico, and is certain to yield many new species of plants and animals when its exploration becomes possible. The native Yaquis, some of whom were in the employ of the Mexican section of the survey, are a brave, semicivilized race. Within a short period Mexico had succeeded in making a treaty with them, but shortly after war again broke out, and it is to be expected that all attempts to explore the Yaqui territory in the near future will prove as futile and disastrous as in times past—certainly much more difficult than I would have found it with my friendly native guides. I therefore look back with much regret to the lost opportunity of which my own sickness and the necessity of caring for a severe injury to the kneejoint of one of my companions deprived me.

It was fortunate that I had so little professional work on my hands, not one of the party having left the survey on account of wounds or sickness, for I was therefore left comparatively free to make observations and to collect materials for the biological report during the first two years of the survey, and during the last year was practically independent, serving with the Monument-Building Party, which, as before mentioned, was organized at the end of the first six months and continued its work of erecting monuments on sites previously marked, for several months after the survey proper had been dissolved. During this last year, which was spent along the two western azimuth lines and the small Colorado River section of the Boundary Line which connects them, my little party of 10 men made independent camps, and, though obliged to keep in the general neighborhood of the monument-builders, selected quiet camps in the most desirable situations and was never hampered by the necessity of caring for the sick, as no serious cases of illness occurred during this period among the now hardy and veteran engineers and explorers. In addition to the work along the line, two important expeditions were made. The first of these was a reconnoissance of the lower portions of the Gila and Colorado rivers from Adonde Station, on the Southern Pacific Railroad, to the mouth of the Gila River at the town of Yuma, Arizona, and thence along the left (east) bank of the Colorado River to the Gulf of California. When the Pacific Ocean was reached, the little camp of the biological section was pitched at the mouth of the Tijuana River, near the last Monument (No. 258); but the habit of moving on to the westward had so grown upon its members during the three years of their wanderings that arrangements were soon made with the Treasury Department at Washington to carry them out to San Clemente Island, the most outlying of the Santa Barbara group, on the revenue cutter *Wolcott*, Capt. W. D. Roath commanding. These two expeditions were more fraught with adventures and thrilling episodes than any other part of the exploration, while they resulted in very considerable gains to science. Of the trip to San Clemente, on which Prof. T. S. Brandegee, an eminent botanist of California, and Mr. A. W. Anthony, a well-known ornithologist, accompanying my party, more will be said later.

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[a] Proc. U. S. Nat. Mus., XXI, 1899, pp. 773–788, with map, pl. LXXXV.

PERSONS WHO PARTICIPATED IN THE FIELD WORK OF THE BIOLOGICAL SECTION.

The following-named persons were engaged, at different times, in making biological collections in connection with the operations of the International Boundary Commission:

1. EDGAR A. MEARNS, captain and assistant surgeon, U. S. Army. From January 30, 1892, to September 12, 1894.
2. FRANK XAVIER HOLZNER, assistant field naturalist, employed by the U. S. National Museum from January 30 to December 10, 1892, and from June 1, 1893, to March 31, 1894. When, owing to lack of funds, the National Museum discharged Mr. Holzner at the Colorado River, March 31, 1894, an arrangement was made with the American Museum of Natural History, New York, through Dr. J. A. Allen, whereby Mr. Holzner was continued with the party to San Diego, California, where he is now located and whence, from time to time, specimens of mammals have been sent by him to form a part of the boundary collection.

Mr. Holzner was usually with me, but occupied independent stations, in 1892, on the Hachita Grande, San Luis (Turkey Canyon), and San José mountains; and he continued with the main party from the San Pedro River to Nogales (and collected 108 mammals and 117 birds during November and December, 1892), after I was removed by the War Department in November, 1892. He worked alone in the Santa Cruz Valley (and collected 13 mammals and 416 birds) and Huachuca Mountains from June 1 to October 9, 1893, and at Camp Lowell (near Tucson), Arizona, from November 6 to 16, 1893.

3. Frank Wagner, hospital steward, U. S. Army. Collected plants along parallel 31° 47′ from El Paso, Texas, to the lower corner of New Mexico (Monuments Nos. 1 to 53), from August to November, 1892.
4. Harlan E. McVay, first lieutenant and assistant surgeon, U. S. Army. Made a small collection of plants between the San Pedro River and Nogales in November, 1892.
5. Timothy E. Wilcox, major and surgeon, U. S. Army. Forwarded plants for the boundary collection from Fort Huachuca, Arizona, during the summer and autumn of 1893. These were additional to the extensive collection sent by him personally. All were subsequently sent to Dr. N. L. Britton, in New York, and were made the basis of a special paper on the flora of the Huachuca Mountains.[a]
6. Ernest C. Merton, acting hospital steward, U. S. Army. Collected plants between the San Pedro River and Dog Spring (Monuments Nos. 98 to 55) from August 1 to September 23, 1893.
7. Ludwig Schoenefeldt, hospital steward, U. S. Army. Collected plants assiduously from Fort Yuma, California, to the Pacific Ocean and San Clemente Island from April 6 to September 9, 1894.
8. David Du B. Gaillard, first lieutenant, Corps of Engineers, U. S. Army, commissioner. Frequently brought specimens of plants to the collectors in the field during the progress of the survey.
9. Louis di Zerega Mearns collected mammals, birds, mollusks, and plants at Fort Clark, Kinney County, Texas, from November 15, 1897, to June 15, 1898.

The soldiers who served with the biological section were: Frank Wagner, John York, Henry Kramer, Arthur M. Pino, Ernest C. Merton, Starks W. Johnson, John J. Simon, Jesse Redman (teamster), Charles Hackborth, Ludwig Schoenefeldt, James Teagle (teamster), and Privates Randolph, Edwards, and Ford, special escort from Gardners Laguna to San Diego.

ACKNOWLEDGMENTS.

My grateful acknowledgments are due to each of the three commissioners, to the army officers, the assistant engineers in charge of the work, and, in fact, nothing short of an enumeration of the entire party would specify the individuals to whom I am indebted for favors and uniformly helpful and courteous treatment. Probably nowhere has a party of similar size performed an equally large amount of work, in such a spirit of good fellowship. Our association with the Mexican Commision was one of unbroken friendship, cemented by continued companionship and hardships shared in common.

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[a] An enumeration of the plants collected by Dr. Timothy E. Wilcox, U. S. A., and others in southeastern Arizona during the years 1892–1894, by N. L. Britton and T. H. Kearney, jr., Trans. N. Y. Acad. Sci., XIV, 1895, pp. 21–44.

MONUMENTS AND BOUNDARY SECTIONS.

The Mexican Boundary Line consists of seven sections, two of which are formed by portions of two rivers—the Rio Grande and Colorado; two are straight oblique or azimuth lines; two are sections of parallels or lines following the earth's curve; and one is a meridian or north and south line.

The longest section of the Boundary is that formed by the Rio Grande, which rises in Colorado and flows 1,700 miles to the Gulf of Mexico and forms 1,100 miles of the Boundary Line on its lower course. This Rio Grande section was surveyed by a separate Commission, consisting of Col. Anson Mills, U. S. Army, and another commissioner appointed by the Mexican Government.

The boundary sections are shown in fig. 1.

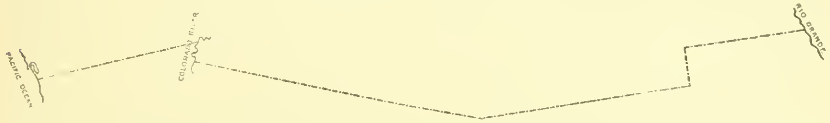

FIG. 1.—DIAGRAM SHOWING SECTIONS OF MEXICAN BOUNDARY LINE (SECTION 1 IS OMITTED.)

1. The Rio Grande from its mouth to a point about 3 miles above El Paso, Texas. Extent, 1,770.34 kilometers or 1,100 miles.[a]

2. Parallel 31° 47′ north latitude, from the middle of the Rio Grande, at the last point, west to meridian 108° 12′ 30″ west longitude (Monuments Nos. 1 to 40). Extent, 159.38 kilometers, or 99.03 miles.

3. Meridian 108° 12′ 30″ west longitude, from the last point, south to the parallel 31° 20′ (Monuments Nos. 40 to 53). Extent, 49.83 kilometers, or 30.96 miles.

4. Parallel 31° 20′, from the last point, to meridian 111° 4′ 34.3″ (Monuments Nos. 53 to 127). Extent, 272.94 kilometers, or 169.59 miles.

5. Sonora azimuth line, from the last point to the Colorado River, latitude 32° 29′, longitude 114° 46′ 48″.7 (Monuments Nos. 127 to 205.) Extent, 377.13 kilometers, or 234.33 miles.

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[a] The Boundary Commission with which I was connected as medical officer and naturalist had nothing to do with the survey of this first section, but conducted that of the six remaining sections from the Rio Grande to the Pacific Ocean.

6. Colorado River, from the last point north to Monument No. 206, 10 kilometers or 6 miles from the town of Yuma, Arizona, latitude 32° 44′, longitude 114° 37′ 23″.4. (Monuments Nos. 205 to 206.) Extent, 40.41 kilometers, or 25.11 miles.

7. California azimuth line, from the middle of the Colorado River, at the last point southwest to the Pacific Ocean, latitude 32° 32′, longitude 117° 7′ 32″.589. (Monuments Nos. 206 to 258.) Extent, 226.89 kilometers, or 140.98 miles.

Of the boundary monuments erected by the engineers of the old Mexican Boundary Survey, 43 were identified and repaired or replaced, and 215 new points were established and marked with iron monuments by the Commission under which I served, which gives a total of 258 monuments now marking the line from the Rio Grande to the Pacific. These are consecutively numbered from east to west, No. 1 standing on the right (west) bank of the Rio Grande, and No. 258 on the shore of the Pacific Ocean. As the distance is about 1,127 kilometers, or 700 miles (including the short section formed by the Colorado River between Monuments Nos. 205 and 206), the average distance apart is 4,380 meters, or 2.72 miles, and in no case has the limit of 8,000 meters been exceeded. Each monument bears its number and inscription.

In order to facilitate comparison of the records of localities with reference to boundary monuments of the two surveys, the following concordance was prepared, at my request, by Lieut. David Du B. Gaillard, Corps of Engineers, U. S. Army:

Concordance of old and new numbers of monuments.

New number.	Old number.	New number.	Old number.	New number.	Old number.	New number.	Old number.
1	1	67	15	129	XVIII	191	IV
2	2	73	16	136	XVII	204	III
3	3	77	17	137	XVI		II
15	4		18	141	XV	205	I
21	5	82	19	146	XIV	207	VI
26	6	98	20	150	XIII	220	V
33	7	106	21	160	XII	221	IV
40	8	108	22	161	XI	252	III
46	9	111	23	162	X	255	II
53	10	114	24	168	IX	258	I
62	11	118	25	172	VIII		
64	12	122	26		VII		
65	13	127	27	175	VI		
66	14	128	XIX	184	V		

ITINERARY.

The following is a record of the writer's location each day, from January 30, 1892, to September 12, 1894:

January 30 to 31, 1892.—We crossed the line between Indian Territory and Texas on January 30, traveling thence to Fort Worth, Texas, where the greater part of the following day was spent by Mr. Holzner and myself in examining the country and collecting mollusks and birds on the South Fork of Trinity River.

The forests of Indian Territory and the adjacent portion of Texas through which we passed in going to Fort Worth are largely of oak, with many elms along the streams; and, in fact, the arborescent vegetation is quite varied, though *Juniperus virginiana* was the only conifer noticed. Sycamores and cottonwoods were locally abundant; and the common mistletoe (*Phoradendron flavescens* Nuttall) was frequently noted, from the Red River crossing southward, especially upon the elm. The first prickly-pears (*Opuntia*) were seen at Fort Worth. As our train proceeded from Fort Worth toward El Paso, Texas, red junipers and other timber similar to that in Indian Territory and northern Texas, were seen for several hours; then a more desert-like region was reached near the Brazos River. Yuccas and arborescent opuntias, creosote bushes (*Covillea*), and other western desert plants appeared and increased in numbers.

February 1 to March 14, 1892.—We arrived at El Paso, Texas, on February 1, and there remained until March 14. During this time I was quartered in the city. Daily trips were made to the surrounding country, and mammal trapping and bird collecting were systematically carried on. Excursions were made to Juarez, on the Mexican side of the Rio Grande, to the Franklin Mountains, and down to the cultivated lands about Ysleta on the Texas side of the river. After February 17, on which date Mr. Holzner moved to the first camp of the surveying party, on the east bank of the Rio Grande opposite to the initial monument of the survey, I made daily visits to that camp.

March 14 to 15, 1892.—Broke camp on the east side of the Rio Grande and crossed on the bridge from El Paso to Juarez, then passing up the west shore of the Rio Grande and making camp opposite old Fort Bliss, Texas.

March 15 to 20, 1892.—On the way to Monument No. 15, across a plateau about 1,250 meters (4,101 feet) above sea level, and about 100 meters (328 feet) higher than the Rio Grande at the initial monument. This plateau is described as a desert; but, though dry, it is productive. The eastern half is covered with sandhills, built up by the low mesquite, sagebrush, and yucca. Near the middle of this tract, which measures about 80 kilometers, or 50 miles on the boundary, were seen two juniper trees (*Juniperus monosperma*) from which we took specimens.

Parosela scoparia (Gray) Heller is a very characteristic shrub of this desert. The western half is covered with a black grama grass (*Bouteloua eriopoda* Torrey). Here and there large patches of the gregarious creosote bush (*Covillea tridentata*) were seen and smaller ones of *Kœberlinia*, *Ephedra*, and "ocotillo;" and *Perezia*, with its papery spinulose-dentate leaves grew abundantly in the shelter of shrubs, associated with a curious gourd, *Ibervillea lindheimeri* (Cogniaux) Greene. Cacti were not numerous, though several kinds were found sparsely, and prickly-pears were common in a few places. The gold fern was abundant on rocky buttes in the vicinity of Monument No. 15.

About 47 kilometers (29 miles) west of the Rio Grande the first hill of considerable size was reached. Forty-eight kilometers (30 miles) from the initial monument is a depressed, oblongated basin, in which are several lava buttes, where we gathered specimens of volcanic scoria (basaltic lava) varying in color from red to black and gray. This spot was indescribably rough, dismal, and forbidding. Near Monument No. 11 we reached a number of volcanic buttes and low hills called Sierra Seca, the country being everywhere strewn with scoriaceous basalt and other effusive rock. We continued through a similar country to Monument No. 15, about 80 kilometers (50 miles) west of the Rio Grande, in the midst of the Seca and Aguila mountains.

March 20 to April 7, 1892.—In camp near Monument No. 15, distant 80 kilometers, or 49.6 miles, from the Rio Grande.

April 7 to 15, 1892.—Moved to Monument No. 21, near Columbus, New Mexico, on April 7, remaining there until April 15. During this time daily visits were made, either by Mr. Holzner or myself, to Lake Palomas, in the Mimbres Valley, 5 miles southwest of our camp, in Chihuahua, Mexico. Our camp was a short distance south of the Boundary Line.

Between Monuments Nos. 15 and 24 there are no ledges of rock. The low hills and cliffs southwest of Monument No. 23 (about 9.7 kilometers or 6 miles west of Lake Palomas) are of dark-brown augite-andesite, a kind of effusive rock which was abundant as "float" in this neighborhood, but was not again found until we reached the shores of the Pacific Ocean and San Clemente Island. In the higher hills of this locality much of the rock is rhyolite. In the broad plain between Monuments Nos. 26 and 31 are outcroppings of rhyolite of a light-gray porphyritic variety.

April 15 to 22, 1892.—On April 15 moved from near Monument No. 21 to near Carrizalillo Springs and Monument No. 33, camping on the New Mexican side of the Boundary until April 22. Collections were made principally in the Carrizalillo Mountains. At that time many of the earliest plants were beginning to flower.

April 22 to May 15, 1892.—Moved April 22 from near Monument No. 33 to the "Upper Corner" or Monument No. 40, at the west end of the second section of the Boundary Line formed by the parallel 31° 47′ north latitude, and camped there until May 15, exploring carefully the hills and plains in the vicinity of the camp, but making no extended trips.

May 15 to 18, 1892.—Moved to Mosquito Springs, Chihuahua, Mexico, near Monument No. 46, on May 15, remaining there until May 18. Collections were made principally on the Mexican side of the meridian (108°, 12′, 29″.64, West) forming the third boundary section.

May 18 to 19, 1892.—Accompanied by Lieut. Francis G. Irwin, jr., Second Cavalry, Mr. F. X. Holzner, and a section of the pack train, rode to Big Hatchet Mountains, in Grant County, New Mexico, camping on a shoulder of the main Hachita Peak, in the piñon-pine zone, at the altitude of about 1,800 meters (5,905 feet), and proceeding thence on foot to the summit (altitude 2,545 meters or 8,350 feet). On May 19 I again climbed to the summit and examined traps set on the preceding day for mammals, after which we returned to Mosquito Springs. A supply of water was left in kegs for Mr. Holzner, who remained until May 25.

May 20 to June 4, 1892.—On May 30, in company with Lieutenants Gaillard and Irwin, rode to White Water, Chihuahua, Mexico (near Monument No. 61), and camped there for the night, proceeding on the following day to the San Luis Springs (now known as Lang's Ranch), where we camped and spent the first day of June in exploring the west side of the San Luis Mountains. On June 2, we retraced our steps to White Water, returning to the main camp at Dog Spring, New Mexico, on June 3. Although made for the purpose of locating future camps where wood, water, and grass were to be had, this was a successful hunting trip, two Arizona deer (the first obtained), seven antelope, two black timber wolves, two turkeys, and a variety of small game and specimens having been killed and brought in by the three officers.

June 4 to 12, 1892.—In camp at Dog Spring. From this camp visits were made to the "Lower Corner" Monument (No. 53), at the eastern extremity of the fourth section of the boundary formed by the parallel of 31° 20′ north latitude, and the Dog Mountains to the northward, of which Emory Peak is the most prominent, were quite thoroughly explored. Many plants were found flowering at this season, and the type specimen of a new species of deer (*Odocoileus crooki*) was killed by the writer.

June 13 to 17, 1892.—On June 13 our camp was removed to White Water (near Monument No. 61), which remained our base camp until June 29. From here the East and West Playas valleys or plains and the eastern slopes of the San Luis Mountains, the highest crossed by the Mexican Boundary Line, were explored. Our camps were well supplied with game, which was very abundant. At Lieutenant Irwin's camp, at San Francisco Water, antelope were shot by troopers in camp firing by word of command as at target practice, and, to the regret of all but the soldier who did the deed, a male two-year-old mule deer was shot after it had satisfied its thirst by drinking from the cook's water barrel in the shade of a tent fly in the main camp at White Water.

June 18 to 22, 1892.—On June 18, in company with Lieutenant Irwin, I rode to a stream in San Francisco Canyon, south of the Boundary on the east side of the San Luis Mountains; camping there for the night, we ascended the mountain on the succeeding day and returned to White Water, where we remained until June 22.

June 22 to 27, 1892.—On June 22, moved to a stream of the San Luis Mountains, in San Francisco Canyon, where we camped, accompanied by Mr. Holzner, until June 27, when we returned to White Water. From this camp a careful examination, extending from base to summit of the San Luis Mountains, was made. The presence at the time of numerous Sonoran grizzly bears and of the " Kid " and his band of renegade Apache Indians added danger to this and subsequent trips into this still wild region.

June 28 and 29, 1892.—June 28 was chiefly occupied in packing specimens. On the following day the main camp was removed to Lang's Ranch, at the western base of the San Luis Mountains, on the edge of the Animas plain. This was our base camp until July 28, and from here the western slopes of the San Luis Mountains were repeatedly explored.

June 30 and 31, 1892.—Remained at Lang's Ranch.

July 1 to 4, 1892.—On July 1, Lieuts. F. G. Irwin and J. R. Seyburn, with a small hunting party, accompanied me to springs at the head of the right fork of Cajon Bonito Creek, in Chihuahua or close to the Chihuahua-Sonora line, where we camped until July 4, and then returned to the main camp at San Luis Springs (Lang's Ranch).

July 5, 1892.—Ascended, on the west side, to the summit of the San Luis range, visiting the highest peaks on the Mexican side of the Boundary.

July 6 to 8, 1892.—On July 6, with a small party, including Lieutenants Gaillard and Irwin, rode from Lang's Ranch to the San Bernardino Springs; camped for one night in Guadalupe Canyon, returning as far as the upper spring in Guadalupe Canyon on July 7, and reaching Lang's Ranch on July 8.

July 9 to 13, 1892.—Camped at Lang's Ranch.

July 14 to 18, 1892.—Lieutenants Irwin and Seyburn, and myself, with a small party, rode to Cloverdale, across the Animas Valley, and spent several days in exploring that wild region, returning to the main camp July 18.

July 19 to 27, 1892.—In camp at Lang's Ranch.

July 28 to August 30, 1892.—Left Lang's Ranch July 28 for San Bernardino Springs; camped for one night in Guadalupe Canyon, arriving at San Bernardino July 29. This was our base camp until September 11.

August 31 to September 10, 1892.—On August 31, rode to Cajon Bonito Creek, near its junction with the San Bernardino River, in Sonora, Mexico, camping there for the night and returning to San Bernardino September 1, and remaining there until September 11.

September 11, 1892.—Rode to Piedras Nigras, on the Agua Prieta, in Sulphur Spring Valley, where we camped for the night.

September 12 to October 10, 1892.—On September 12, rode to Johnston's Ranch, near Monument No. 90 and nearly south of Bisbee, Arizona, which is distant about 11.3 kilometers, or 7 miles. This remained our base camp until October 10. From here visits were made to La Morita and the San José Mountains, in Sonora, and to Bisbee and the Mule Mountains in Arizona. The season was unusually dry and flowering plants were scarce.

October 10 to November 1, 1892.—Camp was moved from Johnston's ranch to the San Pedro River at Monument No. 98 on October 10. This was the base camp until November. The surrounding country was explored, and trips were made to the summit of the Huachuca Mountains (North Peak; altitude 2,771 meters or 9,091 feet) on October 21 and 26, 1892.

November 1, 1892, to June 5, 1893.—Having been relieved from duty with the Boundary Commission, and assigned to Fort Clark, Kinney County, Texas, for station, I left the San Pedro River on November 1 and arrived at Fort Clark on November 5, 1892, where I remained on duty until June 6, 1893. Mr. Holzner continued with the surveying party until Nogales was reached, December 10, 1892, when he was dropped from the rolls of the U. S. National Museum until June 1, 1893, when he was again employed at my request. My successor, First Lieut. Harlan E. McVay, Medical Department, U. S. Army, subsequently collected plants, which were added to the collection, but the season was late and the number consequently small. The specimens of trees from the Patagonia Mountains, however, filled a gap in the collection.

June 6 to July 3, 1893.—Having been ordered on temporary duty to Fort Hancock, El Paso County, Texas, I left Fort Clark on June 6 and arrived at Fort Hancock on the following day, remaining there until July 2, when I was relieved from duty at Fort Hancock and started for Fort Clark, arriving July 3. While on temporary duty at Fort Hancock some collections were made between there and El Paso, Texas.

July 3 to 14, 1893.—Stationed at Fort Clark, Texas.

July 15 to 17, 1893.—Having been reassigned to duty with the International Boundary Commission, I left Fort Clark, Texas, on July 15 and arrived at Fort Huachuca, Arizona, on July 17, 1893.

July 17 to 27, 1893.—This time was spent at Fort Huachuca, Arizona, organizing for service with the Monument-Building Party, then engaged in erecting boundary monuments from the corner 8 miles west of Nogales (Monument No. 127) to the eastward along the fourth section of the Boundary on parallel 31° 20′ north latitude, ending at Monument No. 53. I joined the party at Monument No. 98 on July 27, 1893, after establishing Mr. Holzner in camp on the Huachuca Mountains, where he remained, frequently changing his location, until October 9, 1893, when I rejoined him at Fort Huachuca. From June 1 to July 23, 1893, Mr. Holzner had been stationed at Nogales at Monument No. 118, on the Santa Cruz River, and in the neighboring Patagonia Mountains.

July 28 to 30, 1893.—At the San Pedro River.

July 31, 1893.—Rode and climbed to the highest summit of the Huachuca Mountains (altitude 2,887 meters or 9,472 feet), returning to camp on the San Pedro River during the following night.

August 1 to 3, 1893.—August 1 was spent in preparing the specimens obtained on the Huachuca Mountains. On August 2 camp was moved to Johnston's steam pump, near Monument No. 93, where I remained until the 4th.

August 4, 1893.—Rode to the San José Mountains, in Sonora, Mexico. Accompanied by Lieut. George H. McMaster, climbed to the summit of San José Peak, altitude 2,541 meters, or 8,337 feet, and returned to Johnston's steam pump the same night.

August 5 to 12, 1893.—Rode, on August 5, to a canyon on the north side of the San José Mountains, and camped there with one soldier until the 12th, making daily visits to the summit of the highest peak. On August 12, rode to the camp of the Monument-Building Party at Dutch Charley's ranch, near Monument No. 88.

August 12 to 14, 1893.—Remained in camp near Monument No. 88 until August 14, when I rode to Niggerhead Mountain, Monument No. 82, and made camp.

August 15 to 17, 1893.—Remained at Monument No. 82 until August 17, when camp was moved east to San Bernardino Springs, Monument No. 77.

August 18 to 23, 1893.—Camped at the San Bernardino Springs until August 23, and explored the San Bernardino Valley for a considerable distance to the southward.

August 24 to 29, 1893.—Moved camp August 24 to Hall's Ranch in Guadalupe Canyon, at Monument No. 73, and remained until the 29th. The hilly country between Guadalupe Canyon and the San

Bernardino Valley was explored, and numerous visits were made to Cajon Bonito Creek to the southward.

August 30, 1893.—Rode through Guadalupe Canyon to the Animas Valley, and camped there for the night.

August 31, 1893.—Moved to Lang's Ranch and pitched camp, climbing thence to near the summit of the San Luis Mountains, returning to camp the same night.

September 1 to 9, 1893.—Camped at Lang's Ranch. Several excursions were made to the San Luis Mountains, the west side of which was explored from base to summit; and on September 8 and 9 a trip was made to Cajon Bonito Creek, both forks of which were explored.

September 10, 1893.—Moved camp from Lang's Ranch to White Water, Chihuahua, near Monument No. 61.

September 11, 1893.—Rode to San Francisco Canyon, about 16 kilometers (10 miles) south of the Boundary, and climbed, on the east side, to the summit of the San Luis Mountains, returning to camp at White Water during the following night.

September 12 to 15, 1893.—Camped at White Water, whence the eastern base of the San Luis Mountains and the Playas Valleys were explored until September 15, when camp was moved to Dog Spring, Grant County, New Mexico, near Monument No. 55.

September 16 to 22, 1893.—Camped at Dog Spring, from which point Emory Peak and other portions of the Dog Mountains were carefully explored; and trapping for mammals was carried on in the immediate vicinity of the camp.

September 23, 1893.—Having remained with the Monument-Building Party until their work on parallel 31° 21′ was about finished, I obtained authority to return over the Boundary Line as far west as Nogales, in order to examine the country to the westward of the San Pedro River, which I had never seen, and then to proceed up the Santa Cruz River to the headquarters of the International Boundary Commission, then located in Tucson, Arizona. Accordingly I started to retrace my steps on September 23, when I moved camp to a temporary stream in a canyon at the eastern base of the San Luis Mountains and encamped for the night.

September 24 to October 2, 1893.—The water having ceased to flow during the night, the wagons were sent around by way of San Luis Pass to Lang's Ranch on September 24, while I crossed the San Luis Range over Irwins Pass, near Monument No. 65. Lang's Ranch or San Luis Springs remained our base camp until October 2. During this stay the western slopes of the San Luis Mountains were once more examined from base to summit, and the adjacent plain of the Animas was explored. On September 27, accompanied by Hospital Steward Ernest C. Merton, I rode to the forks of Cajon Bonito Creek and camped there for the night, returning to Lang's Ranch September

28, after exploring a greater extent of the upper portion of the Cajon Bonito Valley than had hitherto been done. At this period the dreaded Apache Kid's band of Indians was present in the neighborhood. On September 24 my men obtained the skull of a puma which had just been skinned by these Indians, the puma's body being still warm when the soldiers found it. Steward Merton came upon the Indian camp in a canyon of Cajon Bonito Creek on the night of September 27, but fortunately avoided observation and succeeded in reaching my camp during the night, although a severe storm was in progress and the streams swollen. At daybreak we left this stream which had proved treacherous on several occasions. In 1892, Colonel Barlow and two men, besides myself, had been caught in this canyon when a cloud-burst filled its banks with rushing torrents which bore along huge trees uprooted from the mountain, and which washed away the earth and trees from the springs forming the head of the right fork of Cajon Bonito Creek, utterly devastating and changing the aspect of the locality which had been one of the most attractive on the Boundary. Months later a similar torrent threatened to engulf a hunting party, including Lieutenant Gaillard and myself, camping in the broad canyon of Cajon Bonito Creek, near its junction with the San Bernardino River. Fortunately the animals and packers were encamped on the bluff out of reach of the water; but the rest of the party only saved themselves and their belongings by hastily suspending their guns, bedding, saddles, etc., to the limbs of a huge sycamore tree into which they climbed and remained until the flood had passed. The volume of water was surprisingly great as no rain had fallen near us, though mutterings of thunder were heard during the afternoon at the distant source of the stream in the San Luis Mountains. The water reached us near midnight, when we were awakened by the noise and warned by sight of a descending column of water, white in the moonlight, stretching across the valley. We were sleeping upon a hummock which was not inundated by the first wave, but was soon covered by the rapidly rising water until only the sycamore stood above the flood, appearing to our packers on the bluff much "like a Christmas tree."

October 2 to 4, 1893.—Moved camp to Hall's Ranch, in Guadalupe Canyon, and remained until October 4.

October 4, 1893.—Sending the wagons by a more direct route, I left the Boundary near Hall's Ranch and, accompanied for a part of the distance by Lieut. George H. McMaster, followed out the course of Guadalupe Canyon to its junction with the San Bernardino River, which latter was then ascended to a camp on the Boundary at San Bernardino Springs and Monument No. 77.

October 5 and 6 were spent at the San Bernardino Springs.

October 7, 1893.—Proceeded to Dutch Charley's Ranch, Monument No. 88, and camped there until the next day.

October 8 to 10, 1893.—October 8 we skirted the southern end of the Mule Mountains, entering the deep cleft of these mountains in which the thriving "Copper Queen" mine is located, and camped at Bisbee, Arizona, until the morning of October 10, when we proceeded to Fort Huachuca, near the northeastern extremity of the Huachuca Mountains. Here Mr. Holzner joined our party on October 9.

October 10 to 16, 1893.—At Fort Huachuca, spending most of the time in packing specimens for shipment.

October 16, 1893.—Moved camp to Frond's Ranch, in Millers Canyon, about 12 miles south of Fort Huachuca.

October 17, 1893.—Ascended North Peak, the second in point of height in the Huachuca Range, returning to camp the same night. Mr. D. R. Payne, photographer of the Commission, who accompanied my party from Lang's Ranch to Nogales for the purpose, made numerous photographs of the trees of the Huachuca Mountains as well as other portions of our route.

October 18, 1893.—Moved to the Cienega Ranch, on Babocomeri Creek, and camped for the night.

October 19, 1893.—Proceeded to the Santa Cruz River, near La Noria, camping for one night at Monument No. 111.

October 20 to 23, 1893.—Followed the Santa Cruz River southward to the old Spanish town of Santa Cruz, in Sonora, and camped there until the morning of October 23, when we continued our course down the river, which at length curved again toward the north and brought us nearly up to the Boundary Line on the west side of the Patagonia Mountains, where we camped for the night on the west bank of the stream.

October 24 to 28, 1893.—On October 24, we continued westward to Nogales, and camped with the Mexican section of the Survey in the Spanish half of the town until October 28. During that time excursions were made into the Pajaritos Mountains. On October 28, we again followed the valley of the Santa Cruz River northward to the ruined mission of Tumacacori, where we made camp.

October 29, 1893.—We took up our course and reached a point on the Santa Cruz about 40 kilometers (25 miles) below Tucson, Arizona, where we arrived October 30.

October 30 to November 30, 1893.—Remained in camp at Tucson, Arizona, whence the neighboring country was explored and several visits made to the abandoned army post of Camp Lowell, on Rillitto Creek, where Mr. Holzner was stationed from November 6 to 16, 1893.

November 30 to December 7, 1893.—November 30, in company with Lieut. Col. J. W. Barlow, left Tucson, on the way for the Boundary

Line, and traveled to near Arivaca, where camp was made for the night. We reached the camp of the Monument-Builders at Warsaw Mills December 1, and camped there until December 7, exploring the Pajaritos Mountains. Trips were made from this camp to Bear Valley and Oro Blanco Picacho.

December 7 to 10, 1893.—On December 7 rode to Arivaca and thence to a ranch in the Tres Bellotas Canyon of the Pajaritos Mountains, where we remained until the next day, when we returned to Arivaca, camping for the night on Arivaca Creek, a few miles beyond the town. Proceeded, December 9, to La Osa, near Monument No. 140, and made camp. This was our base of operations until December 28.

December 11 to 28, 1893.—December 11 drove to Tucson, Arizona, accompanying Colonel Barlow, who had fractured his forearm. The return trip occupied two days. The intervening night was spent at La Ventana Ranch. From December 14 to 28 we remained at La Osa making collections.

December 28, 1893, to January 8, 1894.—On the morning of December 28 we broke camp at La Osa and moved west to La Ventana, where we camped, pursuing our journey on the following day to Pozo de Luis, a few miles south of the Boundary, in Sonora, Mexico, near Monument No. 152. Collecting was carried on at Pozo de Luis until the 8th of January.

January 8 to 25, 1894.—On January 8 we again took up our course westward, camping for one night at the Papago Indian village at the point of the Nariz Mountains, near Monument No. 159. On the following day, after exploring the Nariz Mountains, the journey was resumed, and, passing by the Santa Rosa Mountains (Monuments Nos. 162 and 163), we arrived at the Mexican town of Sonoyta, in Sonora, a few miles south of Monument No. 168, on the night of January 9. From January 9 to 25 we gathered large collections at Sonoyta and made several excursions to the Mexican town of Santo Domingo, on the Sonoyta River, nearly south of Monument No. 171.

January 25 to February 8, 1894.—We left the camp on the Sonoyta River January 25 and moved to Quitobaquita, at Monument No. 172, camping just north of the Boundary until February 8.

February 8 to 14, 1894.—Leaving Quitobaquita on the morning of February 8, we followed the Sonoyta River westward to Agua Dulce, where we left the river and proceeded westward to La Représo, (Monument No. 179) where we camped for the night. Making an early start on the morning of the 9th, I rode from La Représo to Tule Wells, about 48 kilometers (30 miles). The first 6 kilometers (4 miles), to Monument No. 180, was across a plain covered with the creosote bush. At Monument No. 180 is a bare flat 3 kilometers in width, bordered with mesquite, palo verde, and acacia trees. The mountains and hills throughout the region are covered with a thin flow of lava, which reaches a little way out on the plain. The tops of the hills are red lava, the foothills black or dark gray scoria. A long range—the Sierra Pinta—extends from near the Boundary as far as the eye can reach to the northwest. This presents a curious appearance, from its eastern half being covered with black "mal país," or volcanic scoria, which abruptly ends in a sharply defined but irregular line, corresponding to the tortuous course of a vertical ridge. The western half of this range of mountains is of granite and very light in color, the eastern half being almost black. At Monument No. 181 the line crosses a scoria-bestrewn divide on which *Cereus giganteus* grows; and then another broad sandy plain, covered with fine yellowish grass and the creosote bush, is crossed. This is the most dismal part of the dreaded Tule Desert. On the western edge of this plain, which rises toward the Tule Mountains, giant cacti, a species of *Cylindropuntia* called "tasajo" by the Mexicans, and an agave are found on the rocky sides of the mountains—the first agaves seen since we left Pozo de Luis, at which point *Dasylirion* also disappeared. The road here entered a narrow defile among the Tule Mountains, which are mostly granite, with large veins of white quartz, dipping to the east. These mountains, which at a distance appear to be a solid range, are found to be a collection of isolated peaks and sharp ridges cut down between to the general base level, so that it is possible to ride among them without crossing high divides. After riding 8 kilometers (5 miles) through the separated Mountain masses, Tule Wells was reached. The teams had advanced to near the western edge of the Tule Desert, where it became necessary for them to halt for the night. Having a good horse, I rode ahead to the Tule Wells for the purpose of watering the horse, and camped there until the next day, when the teams arrived, much jaded by the long pull across the deep sand of the Tule Desert. We remained at Tule Wells until February 14, exploring the Tule Mountains and surrounding country. I made visits, on February 10, 12, and 14, to a nameless range of mountains northwest of Tule Wells, which I have called the Granite Mountains.

February 14 to 23, 1894.—Camp was moved from Tule Wells to Tinajas Altas February 14, on which day I crossed the Granite Mountains on horseback and rode across the Lechuguilla Desert, the Lechuguilla Mountains, and across the eastern portion of the Yuma Desert as far as Monument No. 198, returning the same night to where the camp had been located at Tinajas Altas, at the east base of the Gila Mountains, 8 kilometers (5 miles) north of the Boundary, in Yuma County, Arizona. From February 14 to 23 we were camped at Tinajas Altas, and made a careful exploration of the Gila Mountains, this portion of which is known as the Sierra de las Tinajas Altas, and of the Lechuguilla Desert east of them.

February 23 to March 1, 1894.—Owing to the looseness of the sand and the great number of burrows of the desert kangaroo rat (*Dipodomys deserti*), which made hauling difficult for the teams upon the Yuma Desert, it was considered best to take another route to Yuma. Accordingly, we moved north to the Gila River and camped at Adonde Siding, on the Southern Pacific Railroad, where we remained until March 1.

March 1 to 13, 1894.—On March 1, we broke camp at Adonde and moved down the Gila River to Gila City, a station on the Southern Pacific Railroad, at the north extremity of the Gila Mountains. We stayed at Gila City until March 5, when we followed the Gila River to its confluence with the Colorado River, and pitched camp at the town of Yuma, Arizona, on the south bank of the Gila, remaining there until March 13.

March 13 to 15, 1894.—On March 13, my camp was moved from Yuma to the Boundary at Monument No. 204, in the Colorado River bottom, at the western edge of the Yuma Desert. This was the base camp until March 31.

March 15 to 16, 1894.—On March 15 I moved out eastward upon the Yuma Desert as far as Monument No. 200, where I spent the night, and returned to Monument No. 204 the next day. Mammals were trapped and the desert explored east to Monument No. 198.

March 17 to 22, 1894.—In camp at Monument No. 204, collecting on the edge of the Yuma Desert and in the Colorado River bottom.

March 23 to 30, 1894.—Having arranged to explore the lower portion of the Colorado River, I set out on March 23, accompanied by two soldiers, with an army wagon hauled by eight mules, and traveled 48 kilometers (30 miles) to a well, where we camped for the night. On the morning of March 24 we arrived at the Mexican settlement of Colonia Diaz, where a Cocopah Indian helper and guide was procured, after which we proceeded to a point opposite to the mouth of Hardy River and made our camp. From the camp at Hardy River we explored the Colorado to its mouth, and did not begin the return journey until March 29, when we reached La Carpa, arriving at Monument No. 204 on the night of March 30.

March 31 to April 6, 1894.—On March 31, we moved camp up the Colorado to Yuma, Arizona, and crossed the Colorado River and went into camp at old Fort Yuma, California, on April 1. From April 1 to 6 we were engaged in packing and shipping the collections and in gathering specimens in the vicinity of the camp.

April 7 to 18, 1894.—On April 7, we began the journey across the Colorado Desert, advancing to Cooks Wells, where we spent the night. Finding the supply of water almost exhausted, we proceeded to Seven Wells, Salton River, Lower California, which we reached April 8, making our camp there until April 18. While at Seven Wells the Salton River was explored for a distance of 24 kilometers (15 miles) to the westward.

April 18 to 27, 1894.—On the morning of April 18 camp was removed to a beautiful mesquite bower on the bank of Gardners Laguna, where we remained until the 27th, making collections on the lagoon and along the Salton River. This station was about 10 kilometers (6 miles) south of Monument No. 216.

April 27 to May 3, 1894.—We moved from Gardners to Laguna del Alamo, on Salton River, near Monument No. 217, April 27, and the next day marched along the Boundary Line over a stretch of desert land lying partly below sea level, to Unlucky Lake, a large, shallow lagoon of New River, which, like the Salton River, is formed by an overflowing and backing up of the waters of the Colorado River. We remained at Unlucky Lake from April 28 to May 3.

May 3 to 6, 1894.—May 3 the march was resumed, and the course of New River was followed to Laguna Station, where we stayed until May 6. A trip from Laguna Station to Mesquite Lake, between Salton and New rivers, was made and the experience proved a trying one. Mesquite Lake was dry and Laguna nearly so.

May 6 to 16, 1894.—Leaving the New River at Laguna Station, where it turns and flows north, on the evening of May 6, we made the march across this desert during the night, stopping for a few hours' rest at Coyote Wells, soon after dawn resuming the journey to the eastern base of the Coast Range Mountains, where we camped at the first water found, in a narrow canyon on the road to San Diego by way of Mountain Spring. Here we obtained good drinking water for the first time in a month. The heat was so intense that the animals eagerly sought the shadows of rocks, and the men sought shelter from the sun in caves. May 8 was spent in collecting about the eastern base of the Coast Range, and camp was moved up the slope to Mountain Spring (altitude 775 meters, or 2,543 feet) on May 9. We remained at Mountain Spring until the 16th, during which time the summits and eastern slopes of the Coast Range were explored.

May 16 to 31, 1894.—Being desirous of securing some of the alpine species of mammals, camp was made for the night of May 16 on the west slope, near the summit of the Coast Range, for the purpose of trapping. During the afternoon of May 17 we proceeded to Jacumba Hot Springs, in San Diego County, California, close to Monument No. 233. From the 17th to the 31st of May collections were made in the vicinity of Jacumba on both sides of the Boundary and east to the Coast Range summits.

June 1 to 7, 1894.—On June 1 we moved the camp westward along the Boundary, camping a short distance south of the line in Nachoguero Valley, in Lower California, where we remained until June 7, when we proceeded to Campo, in San Diego County, California.

June 8 to 21, 1894.—Desiring to see more of the mountains of the Coast Range, we set out from Campo June 8 and proceeded northward to Mr. J. M. Gray's ranch, where we passed the night, going on June 9 to the summit of the Laguna Mountains (Coast Range) and camping at Campbell's Ranch. From June 9 to 21 we were engaged in exploring and making collections in the evergreen-clad forests which cover the summits of these mountains.

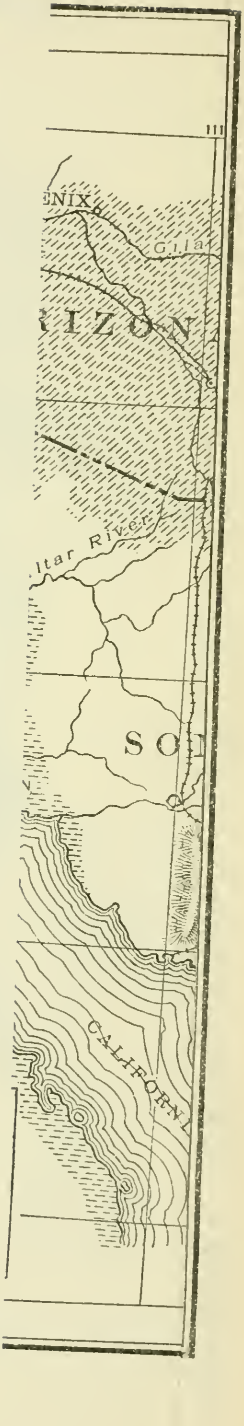
June 21 to 28, 1894.—On June 21, descending the Laguna Mountains to the southward in the direction of Campo, we camped at Thomas Cameron's ranch and remained there until June 23, when we proceeded to Campo, and thence to the Tecate Valley, near the southeastern base of Tecate Mountain. On the Tecate River we were encamped until June 28, and explored the Tecate Valley and Mount Tecate.

June 28 to July 3, 1894.—June 28 I went to San Isidro Ranch, in Lower California, leaving Mr. Holzner and some of the men at Tecate, with instructions to join me, which they did the following day. This fruitful but deserted ranch, whose owners had been killed by Indians, proved to be an ideal collecting ground.

July 3 to 9, 1894.—With regret we left San Isidro on July 3, and, traveling by the Mexican road, crossed Cottonwood and Otay rivers to El Nido, thence up Jamul Creek to an old date-palm tree, where we camped and remained until July 9.

July 9 to 20, 1894.—On July 9 we broke camp at the date palm on Jamul Creek, crossed into the Otay Valley, and thence to the Otay Mesa and town of Tijuana, making camp at the Pacific Ocean, on the left bank of the Tijuana River, near the last Boundary Monument (No. 258). On July 20 we left the Boundary Line at the mouth of the Tijuana River, having explored the estuary of that river and the ocean beaches for some distance in both directions, and marched to San Diego, California. This was our base of operations until the biological work was concluded. Here Mr. Frank X. Holzner left the party, after having been identified with the field work of the biological section of the survey from its beginning.

July 20 to August 15, 1894.—From San Diego the adjacent region was explored, and excursions made to Ocean Beach, La Jolla, up the valley of the San Diego River, to the old Spanish mission, and to the mountains of the interior. In company with Lieut. Col. J. W. Barlow, Mrs. Barlow, and a small detachment of soldiers, we left San Diego on August 3, and traveled west to Alpine, San Diego County, California, where we camped until August 7, when we pro-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ceeded to Pine Valley and camped until August 14 at a place having the altitude of 1,091 kilometers, or 4,200 feet (aneroid), in the pine zone of the Coast Range Mountains. On August 14 we retraced our steps to Alpine and returned to San Diego on August 15.

August 15 to September 12, 1894.—While at San Diego, through the courtesy of the Secretary of the Treasury and of Capt. W. D. Roath, commanding the revenue cutter *Wolcott*, I was enabled to visit the island of San Clemente, about 97 kilometers (60 miles) off the coast of southern California. On this trip I had the company of Prof. T. S. Brandegee and Mr. A. W. Anthony. We left San Diego Bay early on the morning of August 22, and anchored off Smugglers Cove, San Clemente Island, on the evening of the same day, landing with our camp equipage during the forenoon of August 23. We were encamped at Smugglers Cove until August 29, when we returned on the *Wolcott* to San Diego, after exploring the south end of the island and the shore from China Point to its southeast corner. Having received orders to report for duty at Fort Myer, Virginia, I left California on September 9 for the East, passing out of the State of Texas, by the Southern Pacific Railroad, on the morning of September 12, 1894.

GENERAL CHARACTER OF THE REGION EXPLORED.

The General Description of the Country Adjacent to the International Boundary Line, from the pen of Lieut. David Du B. Gaillard, Corps of Engineers, comprising Chapter II of Part II of the Report of the Boundary Commission upon the Survey and Re-marking of the Boundary between the United States and Mexico west of the Rio Grande, 1891 to 1896,[a] published in 1898, must be

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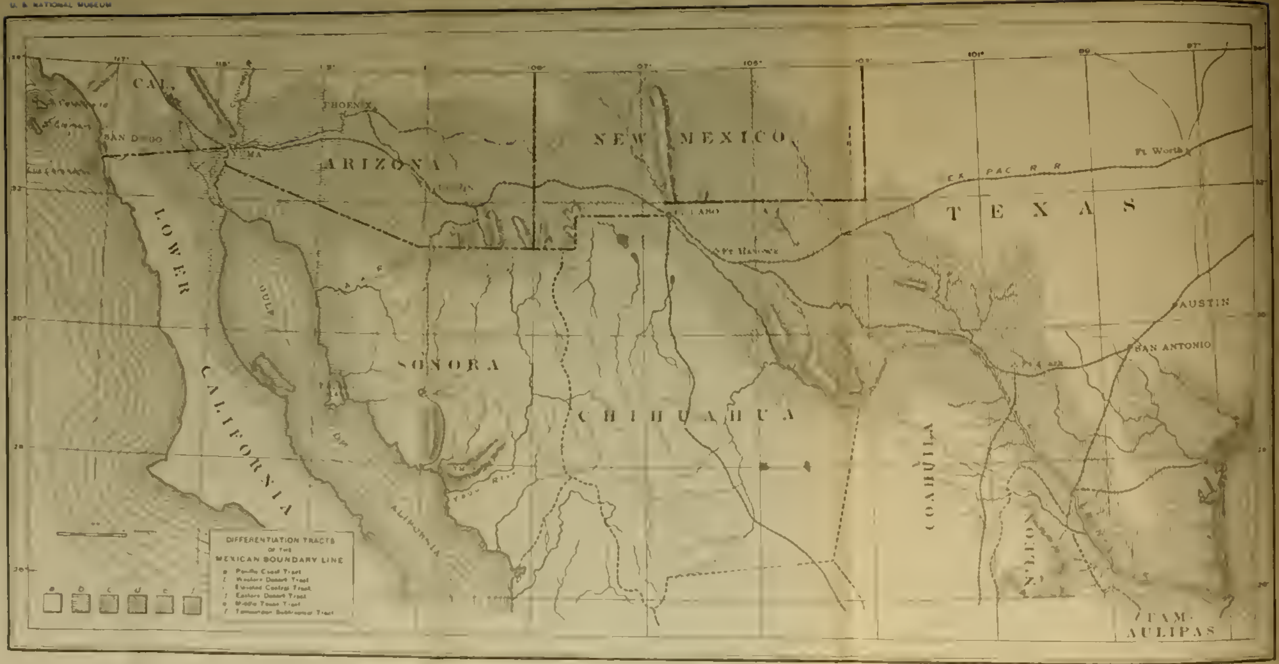
[a] The Report of the International Boundary Commission of the United States and Mexico comprises three bound volumes, as follows:

(1) Report of the Boundary Commission upon the Survey and Re-marking of the Boundary between the United States and Mexico west of the Rio Grande. 1891 to 1896. Parts I and II. Part I, Report of the International Commission. Part II, Report of the United States Section. Washington: Government Printing Office, 1898, pages 1 to 240, 4to, with numerous full-page plates, text figures, and diagrams, none of them numbered. List of illustrations (i. e., full-page plates), Part I, p. 10; Part II, p. 6. Volume without index.

(2) Report of the Boundary Commission upon the Survey and Re-marking of the Boundary between the United States and Mexico west of the Rio Grande. 1891–1896. Album [first title]. Views of Monuments and Characteristic Scenes along the Boundary between the United States and Mexico west of the Rio Grande. Reproduced from photographs taken under the direction of the International Boundary Commission. 1892–1895 [second title].. The regular edition contains 258 half-tone engravings, reproductions of photographs of Monuments Nos. 1 to 258, as they now stand, in sequence, with numbers of monuments and descriptive text in Spanish and English; plates not otherwise numbered; size, 11 by 14 inches. A very limited edition of this Album,


CAL.
SAN DIEGO
YUMA
PHOENIX
ARIZONA
NEW MEXICO
EL PASO
FT. HANCOCK
TEXAS
Ft. Worth
TEX. PAC. R. R.
AUSTIN
SAN ANTONIO
LOWER CALIFORNIA
GULF OF CALIFORNIA
SONORA
CHIHUAHUA
COAHUILA
NUEVO LEON
TAMAULIPAS
117°
115°
113°
109°
107°
105°
103°
101°
99°
97°
32°
30°
28°
26°
a
b
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d
e
f
DIFFERENTIATION TRACTS OF THE MEXICAN BOUNDARY LINE
a Pacific Coast Tract
b Western Desert Tract
c Elevated Central Tract
d Eastern Desert Tract
e Middle Texas Tract
f Tamaulipan Subtropical Tract

read in order to appreciate the physiographic features of the region. Chapter VII, pages 179 to 199 of the same report, containing Lieut. Col. J. W. Barlow's account of the Construction and Erection of New Monuments, also gives much information of value to the biologist respecting the physical aspect and topographic features of the Boundary Line, which are further illustrated by the 300 full-page quarto half-tone engravings of photographs taken along the line.[a]

Lieutenant Gaillard observes: Any general description of the country adjacent to the International Boundary Line between the Rio Grande and the Pacific must of necessity give an incomplete idea of its appearance to one unfamiliar with the arid regions and the peculiar character of its fauna and flora, for probably in no section of the United States of equal extent is the rainfall so small and the summer heat so intense. The average precipitation along the entire boundary is but about 8 inches, and on the Yuma and Colorado deserts but 2 or 3 inches, a deficiency which will be made more significant to the ordinary reader when it is stated that the Boundary Line, although having a total length of about 700 miles, crosses but five permanent running streams between the Rio Grande and the Pacific, and this, too, although crossing most valleys and mountain ranges nearly at right angles, the direction most favorable for encountering all existing streams.

From the summer of 1890 to that of 1893 the entire country between the Rio Grande and the Colorado suffered from a drought of unprecedented duration

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printed on heavy paper, containing 300 plates (259 of new or recently repaired monuments and 41 views of scenery and old monuments as found by the present commission), and lacking the first title page, was issued in advance of the regular publication, the 42 additional plates of this edition being scattered through the text of the report in the final edition.

(3) Folio atlas of maps and profiles, 21½ by 28¾ inches. Title page: Boundary between the United States and Mexico, as surveyed and marked by the International Boundary Commission, under the convention of July 29, 1882. Revised February 18, 1889. List of maps and profiles: A and B, index map of the Boundary; 1, 2, 3, and 4, California line; 5, Colorado River section of the Boundary (in colors); 6, 7, 8, 9, 10, 11, Arizona-Sonora oblique line; 12, 13, 14, 15, and 16, parallel 31° 20′ north latitude; 16 and 17, meridian section; 17, 18, and 19, parallel 31° 47′ north latitude; 20, 21, 22, 23, and 24, profile of the Boundary. A and B show the prominent peaks, roads, and springs in the vicinity of the Boundary Line, whose positions and heights were determined by the United States section of the Commission. The railroads, roads, and trails and the location of settlements, rivers, etc., at a distance from the Boundary were compiled from county maps, General Land Office maps, United States engineer maps, etc.; Pacific coast line and San Diego Bay, from U. S. Coast and Geodetic Survey charts; coast of Lower California and Gulf of California, from U. S. Hydrographic Office charts.

[a] Also see The Perils and Wonders of a True Desert, by Capt. D. D. Gaillard, U. S. Army, in The Cosmopolitan, October, 1896, pp. 592–605, with 18 illustrations in the text; Seriland, By W J McGee and Willard D. Johnson, in The National Geographic Magazine, VII, April, 1896, pp. 125–133, pls. XIV, XV; The Old Yuma Trail, by W J McGee, in The National Geographic Magazine, XII, March, 1901, pp. 103–107; April, 1891, pp. 129–143, with map and numerous text figures.

and severity, the effects of which were intensified by the overstocked condition of the ranges. This state of affairs added greatly to the difficulties and expense of the survey. Vegetation was parched, water holes dried up, and scarcely any grass was left by the famishing cattle. This long drought was broken by abundant rains in July and August, 1893, but not until the stock-raising interests had suffered severely.

The small rainfall of this region generally occurs at two periods of the year—midwinter and midsummer—the latter rainfall the greater and by far the most important; consequently this period is known as the "rainy season." The summer rains generally commence about the 1st of July and cease sometimes between the 1st and 20th of September. It is soon after the first of these rains that vegetation in this region begins to assume a spring-like character. Leaves burst forth, the hills and valleys are covered with grass, and a bewildering profusion of wild flowers covers the entire country. As if conscious of the short duration of the rainy season these grow with great rapidity, and their seeds mature ere the rains cease. In a month of so thereafter they have assumed the somber colors typical of fall and winter. Thus in the short space of three or four months vegetation here enjoys its spring, its summer, and its autumn.

Before going more into details it may be well to note certain general characteristics of this region which at once strike the ordinary traveler.

These are the bare, jagged mountains rising out of the plains like "islands from the sea;" the abundance of the evidences of volcanic action in times geologically recent; the parallelism of the mountain ranges with one another and with the Pacific coast; the general absence of trees; the preponderance of evergreen vegetation, and its dull, leaden-green hue; the prevalence of thorns in nearly all vegetation; the general absence of fragrance in flowers; the resinous character of the odor of the most common trees and shrubs, and the abundance and large size of the cactus.

The entire country along the boundary is thinly settled, the principal settlements within 20 miles of the boundary on either side being at Lake Palomas, Hachita, the Sulphur Spring Valley, La Morita, the San Pedro Valley, the Huachuca Mountains, the Santa Cruz Valley, Oro Blanco, Arivaca, the Baboquivari Valley, the Papago rancherias of Pozo Verde, Cobota, and Pozo de Luis, the Sonoyta Valley, the Colorado River Valley, and the country between the summit of the Coast Range and the Pacific. The only towns within the limits above mentioned are Bisbee, Santa Cruz, Nogales, Yuma, and San Diego. With the exception of these towns and settlements the rest of this zone of about 24,000 square miles contains less than 100 permanent inhabitants.[a]

It is rather remarkable that an arbitrarily chosen line like the one under discussion should, between the Rio Grande and Colorado River, follow almost exactly the summit of the divide which separates the waters flowing north into the United States from those flowing south into Mexico.

Inhabitants.—Many long stretches of the boundary region are almost without inhabitants other than Indians and a few Mexicans. Where there is grazing, the cowboys are found in bands looking after their cattle and herds of horses; but even in such places the stock ranches are scattered far apart. The fleeting "vinaterias" of Mexican "mescal" makers are occasional in canyons of the mountains, and mines, or "prospects," were found in similar localities.

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[a] Although the soil in many places is very fertile, yet the great scarcity of water renders it impossible for the inhabitants to carry on agriculture except to a very limited extent.

Between the San Bernardino and Santa Cruz rivers many Yaqui Indians were seen, mostly in the employ of Mexicans or Americans, about ranches, vinaterias, mines, stores, or on the railroad. They are faithful and reliable men—an improvement on the Americans and Mexicans who served in similar capacities. From the Santa Cruz to the Sonoyta River we were in the home of the Papago, who are devoted to agriculture and placer mining for gold. Their crops are uncertain owing to the scant and irregular rainfall; but when there are no rains they subsist by washing out gold dust in the mountains or selling horses and cattle along the Southern Pacific Railroad. The fruit of the giant cactus ("sahuara"), the "pitaya," "sinita," "segura," and other large cacti are preserved and stored for food on the roofs of their huts. In the Pozo Verde Mountains were seen clusters of tombs in which the Papago dead are deposited. These stone sepulchers are built with infinitely greater pains than the huts in which the occupants resided during their lives. On the Colorado River were found the Yuma, Cocopah, and Diegeño Indians. The Yuma Indians are a cheerful, smiling people, the men being remarkable for their tall stature and splendid proportions. They are great runners and possessed of wonderful endurance. Having always been foot Indians their pedal extremities are more developed than those of other Indian tribes, though relatively not larger than those of the whites. The Yuma were filled with undisguised admiration of the huge feet of some of the negro soldiers of the Twenty-fourth Infantry belonging to the survey escort. The most striking characteristic of the Yuma is their sweetness of disposition; when not smiling they are almost sure to be laughing musically. The disparity in the height of the sexes is also remarkable, the women being short and of heavy build, while the men are tall and have superb figures. Their uniform custom of cremating their dead, and the immediate belongings of the deceased, is excellent from a sanitary point of view and worthy of our imitation. Across the Colorado Desert we again found Indians in the mountains of the Coast Range. Probably no human beings are so dependent on the kind offices of birds as are these Indians of the Coast Range of southern California, for when the mountains are deeply covered with snow in winter the Indians are obliged to subsist almost wholly upon the acorns which the more provident woodpeckers (*Melanerpes bairdi*) have stored in the bark of the pine trees.

From the Rio Grande to the Pajaritos mountains evidences of the former existence of the now extinct Cliff Dwellers are abundant. The whole region is strewn with fragments of broken pottery, with stone implements here and there. Their cave-like dwellings were found on the Rio Grande, and a few natural cavities in the cliffs of the Portrillo and Seca mountains had been occupied as residences. In the Dog Mountains are small cliff houses, decorated with chalcedony and in an almost perfect state of preservation. On the banks of the San Bernardino River, in the southeast corner of Arizona, were discovered the large ruined buildings of pueblo pattern. A "gigantic earthwork," in the shape of an ancient dam across the Animas Valley, in the vicinity of Monument No. 67, is fully described and illustrated by Lieutenant Gaillard in the American Anthropologist for September, 1896.

Watersheds.—After leaving the Rio Grande the first divide, which has gradually risen from sea level at the Gulf of Mexico to the altitude of 1,130 meters, or 3,707 feet, at El Paso, is a low one between the Rio Grande at El Paso and the Mimbres at Lake Palomas, the latter flowing south into old Mexico. The altitude of the Rio Grande at the initial point of the Survey is, as just mentioned, 1,130 meters, and that of the Mimbres at the point where the Boundary Line crosses it 1,210 meters, or 3,970 feet.

The highest point on the line is the summit near the northern extremity of the San Luis Mountains, having an altitude of 2,048 meters, or 6,719 feet. From the Animas Valley or plain west of these mountains the sudden break in the high plateau is decended through Guadalupe Canyon, and we find ourselves in the valley of the San Bernardino River, a northern tributary of the Yaqui, with an altitude at the Boundary crossing (Monument No. 77) of only 1,133 meters, or 3,717 feet. Passing through a gap at the southeastern extremity of the Mule Mountains, west of the San Bernardino River, at an elevation of 1,430 meters, or 4,692 feet, the line crosses into the basin of the Gila River, which has an elevation of 1,298 meters, or 4,259 feet, at the crossing of the San Pedro River; 1,393 meters or 4,570 feet, at the first crossing of the Santa Cruz River (Monument No. 111); and 1,130 meters, or 3,707 feet, at the second crossing (Monument No. 118).

West of the Santa Cruz and of the city of Nogales the Pajaritos Mountains are crossed. The initial Monument (No. 127) of the Sonora azimuth section of the Boundary Line has an elevation of 1,592 meters, or 5,223 feet. The drainage from these mountains is toward the Gila River on the north slope, and toward the Altar River on the south. Monuments Nos. 137 to 140, near La Osa, practically mark the dividing line between these basins. At this point the altitude is about 1,100 meters, or 3,609 feet, but rapidly diminishes to 300 meters, or 984 feet, on the Sonoyta River at Quitobaquita to the westward.

From Quitobaquita to the Colorado River lies a gradually sloping stretch of desert sand, crossed by several ridges and two rocky desert ranges of mountains that trend northwest and southeast. At the Colorado River the altitude is 26 meters, or 85 feet.

Crossing the Colorado Desert, 161 kilometers, or 100 miles, in width, the mountains of the Coast Range are reached and miles of desert country lower than the ocean are crossed on the way between Monuments Nos. 220 and 224. Lieutenant Gaillard observes:

> Salton and New rivers (temporary channels of the Colorado Desert) present the anomalous condition of two streams parallel to one another and to the axis of lowest depression in their vicinity, the first being about 18 and the second about 8 miles east of this axis, as measured along the Boundary; the corresponding elevations of the surface at each point being +26,′ —7,′ and —16,′ respectively, referred to mean sea level, the last marking the lowest point along the entire boundary line.

Salton and New rivers terminate in Salton Sea, which, according to Lieutenant Gaillard, "is about 250 or 275 feet below mean sea level." After crossing the north spur of Signal Mountain, a prominent peak on the desert south of Laguna Station, "for about 10 miles the line passes over a bare, rocky, water-washed mesa, about 300 feet above sea level, from which, by a succession of three or four terraces, indescribably bare, jagged, rough, and precipitous, the line in a distance of about 11 miles attains the summit of the Coast Range at an elevation of about 4,500 feet." (Gaillard.) After this abrupt rise from a point below sea level to the crest of the Coast Range, the line slopes quite regularly to the ocean. The east slope of the Coast Range Mountains is abrupt or precipitous throughout Lower California.

Waters.—The only rivers worthy of the name on the Mexican border of the United States are the Rio Grande and Colorado, both of which are variable and subject to great seasonal fluctuations in the volume of their waters. The Rio Grande usually becomes dry at El Paso after the high rise of May and June, and is frequently low during the winter. The Colorado is likewise subject to annual overflows from April to June, sometimes breaking through its right (west) bank and spreading out over the Salton region of the Colorado Desert, where the only lakes of any magnitude occur. These lakes of course eventually dry up by evaporation; but, for a time, the region becomes green and vegetation luxuriates in the rich surface deposit from the water. Cattle have lately been driven in, and the owners endeavor to make a breach in the Colorado River bank at each annual overflow, and if they succeed the region again becomes flooded through the channels of New and Salton rivers, which causes a fresh crop of forage plants to spring into life.

Of the lesser streams, always dignified by the title of rivers in the Southwest, the Mimbres crosses the line, flowing south into the Palomas Lakes, toward Lake Guzman in Chihuahua, crossing the Boundary at Monument No. 19, about 113 kilometers or 70 miles west of El Paso. Lakes Guzman and Palomas are considerable sheets of shallow, alkaline water. The sand wastes surrounding them are covered with a white deposit intolerable to the eye.

Crossing the divide to the west of the great San Luis Range of mountains, Cajon Bonito Creek rises in the San Luis a short distance south of the Boundary. This stream, like the San Bernardino, of which it is a tributary, flows to the Yaqui River. The San Bernardino River rises in southeastern Arizona and joins the Yaqui through the Bavispe River.

Farther west, the San Pedro and Santa Cruz are the only rivers worthy of mention, unless a small stream (Agua Prieta) in Sulphur Spring Valley be excepted. These two are tributary to the Gila, which flows into the Colorado at Yuma.

In the Pajaritos Mountains west of Nogales there is a small stream called Bear Creek, which contains fish, and flows into the Altar River, in the State of Sonora, Mexico. The Sonoyta River, which runs an independent course (mostly dry) to the Gulf of California, also contains fish, and is the only stream of consequence between the Santa Cruz and Colorado rivers.

The Salton and New rivers, previously mentioned, are merely temporary drains which occasionally conduct an overflow of water from the Colorado River to the ancient basin of Salton Sea, west of the Colorado.

The mountains forming the Coast Range break off abruptly along the Colorado Desert and Gulf of California, and, consequently, their drainage is to the Pacific. The Tijuana and San Diego rivers are those which reach the ocean in the vicinity—just to the northward of the Boundary. Each of these has numerous tributaries. The absence of fish in them is remarkable.

Lieutenant Gaillard has given a detailed account of all the springs and wells along the boundary strip, his account being summed up in the following paragraph:

> To persons unfamiliar with the deserts of the Southwest, it will doubtless appear that undue prominence has been given to the question of water in the preceding description of the country along the Boundary, and in refutation of this idea it is necessary to call attention to the fact that supplying the working parties with water on the deserts was the problem of the survey, in comparison with which all other obstacles sank into insignificance. To the traveler on the desert the all-important questions are: The distance to the next water, the nature of the supply, and the character of the intervening roads. For while he may be able to live without food for several days, he knows that, exposed to the scorching heat of summer, men drinking their fill at sunrise frequently become crazed and in some cases perish of thirst before sunset. Nor must it be forgotten that at such times so profuse is perspiration and so rapid its evaporation that the quantity of water consumed by men and animals is very large, averaging at one period of the Survey about 7 quarts a day for the men and 20 gallons for the animals.

Mountains.—The general trend of the mountains is from northwest to southeast. Those forming continuous ranges have the character of knife blades or hatchet shapes thrust up from the plains. Some have irregular or pyramidal forms, and such are usually of volcanic origin. These mountains are seldom well forested, because of the steepness of their slopes, from which the soil is blown or washed almost as fast as it is deposited, leaving the bare rocks, with vegetation only clinging to the crevices, benches, and hollows.

At El Paso the Rio Grande winds between the Franklin Mountains of Texas and the Sierra de Muleros of Mexico. Then for 145 kilometers (80 miles) to the westward the Boundary Line crosses a desert plain, on which isolated desert ranges are visible in the distance the Floridas (altitude 2,224 meters or 7,295 feet [Wheeler]) and Tres Hermanas (altitude 1,742 meters or 5,715 feet), north of the line; in New Mexico, the Boca Grande, and other desert ranges to the southward, in Chihuahua, Mexico.

Between the Mimbres Valley and the meridian section of the line are the Carrizalillo Hills (altitude 1,617 meters or 5,305 feet) and Boca Grande Mountains (altitude 2,295 meters or 7,530 feet), and in the "Panhandle" of New Mexico, the Little and Big Hachitas, the Dog Mountains, the Animas, and the San Luis (practically the Sierra Madre), of which the Hachita Grande rises to the elevation of 2,545 meters (8,350 feet), the Animas 2,677 meters (8,783 feet), and the San Luis to 2,480 meters (8,136 feet).

Crossing into Arizona, the Chiricahua Mountains (altitude about 2,750 meters or 9,000 feet) lie wholly north of the Boundary Line, and the Pedrogosa (altitude 1,990 meters or 6,529 feet) and Mule Mountains (altitude 1,888 meters or 6,194 feet) west of the San Bernardino Valley, almost all north of the line. East of the San Pedro River are the San José Mountains (altitude 2,541 meters or 8,337 feet), in Sonora, Mexico, their summit 5 miles south of the international line, and west of the San Perdo the Huachuca Mountains rise to 2,887 meters or 9,472 feet, and belong to the United States.

In the loop formed by the first portion of the Santa Cruz River, between the San Rafael Valley and Nogales, are the Patagonia Mountains (altitude 2,217 meters or 7,274 feet), which cross from Arizona into Sonora; the Santa Rita and Santa Catalina mountains being a considerable distance to the northward, in Arizona. Between the Santa Cruz River and La Osa (Monuments Nos. 118 to 140), lie the beautiful Pajaritos Mountains, traversed by the Boundary Line and having an altitude of 1,450 meters or 4,757 feet. Between these mountains and the Coast Range of California are several low desert ranges, of which the Tule (highest point on boundary, 618 meters or 2,028 feet) and Gila Mountains (highest point on boundary, 644 meters or 2,113 feet) are the highest. These mountains of the Tule, Yuma, and Colorado deserts are dry, rocky, and extremely barren. When the Coast Range is reached (highest monument 1,371 meters or 4,498 feet), the sterility lessens during the ascent, and the fertility of their west slopes appears in striking contrast, moist verdure everywhere meeting eyes long weary of the sight of glistening desert sands and mountains of bare rock.

Deserts.—The Mexican Boundary Line bisects two great interior deserts, separated from each other by a more fertile elevated central tract, and from the coasts by tracts of forested or chaparral lands. The Eastern Desert Tract is high, averaging over 1,000 meters or 3,280 feet in altitude; the Western Desert Tract being low, that portion known as the Colorado Desert including an immense depression, below the level of the sea. The Eastern Desert Tract is formed by a series of ancient lake basins, many of which are connected by the Rio Grande and its tributaries. The Western Desert Tract is divided by the Great Colorado River.

Geology.—The Rio Grande embayment corresponds to the Tamaulipan Tropical Tract.[a] Between this and the Quitman Mountains of western Texas is what geologists designate the Texan Region, in this work spoken of as the Middle Texan Tract. The Eastern Desert comprises a series of ancient lake basins, bounded on the east by the Quitman Mountains and on the west by the mountains of the Elevated Central Tract; and the Western Desert occupies the site of an ancient sea, situated between the Elevated Central Tract and the Coast Range of California. The Elevated Central Tract lies between the Eastern and Western Desert tracts, and corresponds to the irregular upfolding of the region between the high table-land of Mexico and the great Colorado Plateau, which latter includes the northeastern third of Arizona and the adjacent portion of New Mexico. The lowest transverse depression in the Elevated Central Tract is crossed by the Southern Pacific Railroad. On the south the final break in the Colorado Plateau probably corresponds to the Guadalupe Mountains on the Mexican Boundary Line, where the head tributaries of the Rio Yaqui have cut to the lowest level on this portion of the boundary region. Across northeastern Arizona the Colorado Plateau breaks off sharply, often precipitously, affording a clear view of its geological structure, which is still better shown at the Grand Canyon of the Colorado River to the northward, where a vertical section of the earth's crust a mile in thickness may be plainly viewed. In general, this whole region is of limestone above and sandstone below, overlaid by volcanic rock. The desert ranges of mountains between the Colorado Plateau and the Coast Range of California are mainly of coarse granite and other intrusive rock, more or less covered by and mixed with effusive rhyolite and basalt. In the Coast Range the granite is of a finer quality and associated with gabbro-diorite and hornblende-mica-andesite, to which, on the Pacific coast and San Clemente Island, augite-andesite is added.[a]

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[a] For a description of the faunal "tracts" and life areas of the Mexican Boundary strip see page 70.

FLORA OF THE MEXICAN BOUNDARY REGION.

The flora of the lower Rio Grande Valley is characterized by a distinct tropical element. The Tamaulipan fauna, which mixes with the Texan along the lower course of the Rio Grande, is associated closely with the range of the Texas palmetto (*Inodes texana* Cook). This tree grows in the rich soil of the bottom lands from the neighborhood of Hidalgo nearly to the Gulf, and below the Rio Grande it ranges southward in the neighborhood of the coast to southern Mexico. The bald cypress (*Taxodium distichum*) is another tree of the humid region. Its range extends up the valley of the Nueces, and a few trees have been found between that and Devils River. Beyond the general range of the palmetto and bald cypress scarcely any of the tropical mammals and birds of the Tamaulipan fauna exist.

In the flora of the narrow strip of country which lies between Fort Clark and Devils River many eastern species are represented. The region included between Devils and Pecos rivers marks the transition from the Texan flora to that of the dry interior region, which extends from the Pecos River, in southwestern Texas, west to the Coast Range Mountains of the Californias.

From the summit of the Coast Range to the Pacific Ocean the flora is almost pure Californian.

The broad reach of country lying between the Pacific Coast and Middle Texas tracts, constituting the arid interior region, belongs principally to the Lower Sonoran or Austral Life Zone. In the mountainous portions of this dry interior region a flora analogous to that of the Rocky Mountains is introduced, which, however, is highly colored by forms extending northward from the highlands of Mexico.

Considered as a whole the Mexican boundary strip is, comparatively speaking, a treeless region. Forests are mainly confined to the mountain ranges and the vicinity of streams, which latter are few and of insignificant size. On some of the desert areas arborescent cacti and yuccas form open groves. The streams are regularly lined with trees, of which the Fremont cottonwood, black willow, boxelder, walnut, sycamore, oak, mulberry, ash, and wild china trees are usually the most abundant. Of these the cottonwood and willow are almost certain accompaniments of every permanent stream, and they are usually flanked by a broader zone of mesquite. The desert willow, hackberry, yewleaf willow, and indigo tree occupy arroyos in which there is a slight amount of moisture; and several green-barked species of *Parkinsonia* and *Cercidium*, known collectively as the "palo verde," together with the Sonora ironwood or "palo de hierro," occupy the edges of arroyos and ravines in the foothills of the Western Desert Tract.

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[a] See Petrographic Report on the Rocks from the United States-Mexico Boundary, by Edward C. E. Lord, in Proc. U. S. Nat. Mus., XXI, 1899, pp. 773-782, pl. LXXXV.

The sandy deserts of the southwestern interior present a widely different appearance from the grassy prairies of the northern plains. In the former the grasses, although numerous in species, nowhere form a continuous turf over considerable areas, but are broken up into tufts and clumps, which often require the protection of the shrubs and other coarse plants which make up the bulk of the vegetation. There are a few large alkali flats that are perfectly bare of vegetation; and some of the most sandy spots in the deserts are without plants. But four species of plants, the creosote bush, a sage, an ephedra, and a grass, were seen on the interior of the wide Yuma Desert which stretches between the Gila Mountains and the Colorado River.

Herbaceous plants are abundant in species, though few in individuals. Therefore the region, although seeming rich in plant-forms to the botanist, always strikes the traveler as barren from paucity of vegetation.

Thorny shrubs, ephedras, cacti, yuccas, agaves, dasylirions, and nolinas are the vegetable forms that most appeal to the eye, as well as to the sense of touch of the traveler, who also sees an abundance of bare unoccupied soil, in which nothing grows except after occasional rainy periods which may not recur for several years; for these plants form patches or plant colonies in which prickly mimosas, acacias, kœberlinias, and many other scrubby bushes join forces with the spine-armed cacti and uninviting agaves and yuccas in repelling invasions and, incidentally, give shade, shelter, and stability to the more tender grasses and herbaceous plants. It is fortunate that these impenetrable mats of mixed plant growth are so disposed in tufts, surrounded by bare spaces, because travel would be greatly impeded if the chaparral were continuous.

On the lowest plains and valleys, usually corresponding to the beds of ancient lakes or seas, the soil is apt to be sandy and vegetation scarce. On approaching the foothills, shrubs, herbs, and grasses increase in number and variety; but the broad slopes surrounding the higher mountains are sometimes covered with grasses, dasylirions, and nolinas, without much shrubbery, until the ravines near the lower timber line are reached. Rocky soil is much richer in plant life than sand or clay, because it retains moisture longer.

With the exception of the palo verde and other green-barked trees and shrubs alluded to below, the desert vegetation appears dull and dusty, and the plants often bear pulpy leaves and exude gums and resins, apparently for the purpose of retarding evaporation and preventing the loss of sap when wounded. The foliaceous leaves are usually of small size, and the leaves and joints of the agaves, cacti, and other fleshy plants are covered with waterproof dermal structures, which, if broken, cause the plants to wilt immediately. Other plants in which the leaves are very minute are covered with green bark, which doubtless exercises the physiological function of leaves. Among these bright green trees and shrubs are species of *Ephedra, Holacantha, Canotia, Kœberlinia, Parosela*, and *Menodora*.

Aside from the trees, which are treated of in detail further on, yuccas, agaves, nolinas, and dasylirions are the most characteristic forms of coarse vegetation over large portions of the boundary area. Five arborescent species of the yucca and one *Nolina* are considered as trees. The others have no distinct caudex and cover the ground with bristling tufts of green, which are grateful to the eye and afford shelter to the birds, mammals, and lower forms of life, though the bayonet-pointed yuccas, the spine-armed agaves, and the serrate-leaved dasylirions are often a torment to man and beast in traveling over such a country. Of the acaulescent yuccas, the narrow-leaf yucca, or soapweed (*Yucca glauca* Nuttall), covers large portions of the eastern plains, and the plateau yucca, or Spanish dagger (*Yucca baccata* Torrey), occupies the broken country, its range extending from southwestern Texas and southern New Mexico across the Colorado Plateau, while on the Boundary the range of the splendid Whipple yucca is confined to the mountains of the Pacific Coast Range. All of these yuccas bear panicles of lily-like whitish flowers.

The nolinas, commonly called "bear grass," grow with the beautiful dasylirions; on the slopes leading up to the mountains. The range of the saw-tooth dasylirion (*Dasylirion wheeleri* Watson) does not extend westward beyond the Elevated Central Tract. The Texas nolina (*Nolina texana* Watson), which ranges west to the San Luis Mountains, and the single-stem species (*N. lindheimeri*), which extends as far as the Western Desert, have a very short but thick caudex or trunk, which is concealed by the numerous narrowly linear, serrulate leaves. The former has numerous flower stems, which are shorter than the leaves, while the latter has a single stout stem from four to eight feet in height.

Agaves or century plants do not grow on the desert plains, though one species (*Agave palmeri* Engelmann) appears as soon as the foothills are reached, while another (*Agave applanta parryi*) was found in the greatest abundance on the summit of Hachita

Grande peak; altitude, 2,545 meters, or 8,350 feet. *Agave sonoræ* (Torrey) Mearns[a] covers the foothills of the Pajaritos and Guadalupe mountains like a carpet, making travel difficult; and *Agave deserti* Engelmann is likewise troublesome on portions of the east slope of the Coast Range mountains of California.

Several species of *Ephedra*, greenish, wide-spreading bushes related to the conifers, occur in greater or less abundance throughout the boundary strip.

Vines and climbing plants are not abundant. Grapes, however, are numerous in the Texan Tract, and also occur in moist canyons in the mountains of the Eelevated Central and Pacific Coast tracts. Forms of the Virginia creeper (*Parthenocissus quinquefolia*) and trumpet flower are found in similar places in Texas and the Elevated Central Tract. Several species of *Convolvulus* and *Ipomœa*, and leguminous climbers occur in abundance in moist places. The Texas matrimony vine (*Lycium torreyi* Gray) grows luxuriantly along the Rio Grande, a pale species (*Lycium pallidum* Miers) occurs in the Elevated Central Tract, and still another species of *Lycium* was found in great abundance along the Sonoyta River, in Sonora. Climbing milkweeds of the genus *Philibertella* are of common occurrence along the streams, often ascending to the tops of bushes and small trees. With them clematis or virgin's bower is not infrequently associated, and several species of gourds of the genera *Cucurbita*, *Apodanthera*, and *Ibervillea* cover otherwise bare spaces of ground or entwine themselves in the edges of thickets.

Canes and coarse rushes are mostly confined to the edges of the Rio Grande, Yaqui, and Colorado rivers, and other water-loving plants are likewise of rare occurrence. *Anemopsis*, or "yerba mansa" of the Mexicans, grows wherever there is permanent water with marshy banks, and is the commonest paludose plant of the interior. On the coasts of the ocean and Gulf of California are numerous pulpy-leaved plants said to have been derived from the Asiatic side of the Pacific, among them a bush ranging from the Gulf of California up the alluvial bottom lands of the Colorado and Gila rivers as far as Adonde. A very rank growth of wild hemp and amaranth also extends up the Colorado bottom nearly to the mouth of the Gila River. The cocklebur (*Xanthium*) and *Datura* are also characteristic plants along streams.

The greasewood (*Atriplex*), of which there are several species, is a very characteristic plant of the Lower Sonoran life zone, and so is the creosote bush (*Covillea tridentata*).

The region is famed for its spiny shrubs. Of such, the leguminous genera *Acacia*, *Prosopis*, *Robinia*, *Mimosa*, and *Parosela* are usually called cats claws, and claim a place second only to the cacti in popular detestation. Scarcely less familiar and annoying are the members of the buckthorn family, among them the genera *Condalia*, *Zizyphus*, *Ceanothus*, *Colubrina*, and *Rhamnus*. There are also spiny shrubs of the families *Oleaceæ*, *Saxifragaceæ*, *Rosaceæ*, and many others. None are more undisguised and openly aggressive than *Kœberlinia*, which is necessarily avoided and more easily forgiven than the "ocotillo," which tempts one to grasp a handful of cool leaves in riding past, only to find that every leaf conceals a dagger.

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[a] *Agave geminiflora sonoræ* Torrey, Bot. Mex. Bound., 1859, p. 211. *Agave schottii* Engelmann, Trans. St. Louis Acad., III, 1873, p. 305.

Among the remarkable plants of the mountains of the Western Desert Tract are woody species of milkweed, of *Euphorbia*, and of *Terebinthus* (*Bursera*).

Several genera of the family *Asteraceæ* are coarse and woody. *Aster spinosus* grows in masses resembling asparagus in sandy soil beside streams; *Baccharis* of several species, *Hymenoclea*, and arrowwood (*Pluchea sericea*) form close thickets beside streams or in moist valleys or canyons in the hills, and even the genera *Trixis* and *Senecio* in some species develop into large bushes.

Further details respecting the distribution of the coarser forms of vegetation along the Boundary will be given in the description of the principal collecting stations. A collection of plants aggregating 4,085 numbers and about 10,000 specimens, from the Mexican Boundary Line, was made and turned over to Mr. Frederick V. Coville, Botanist of the United States Department of Agriculture, for the purpose of being reported upon. As the report has not yet been prepared, a list of the trees is here given, together with such notes regarding their abundance and transverse and vertical distribution as have been retained, some knowledge of the forest trees being essential in order to enable the student to acquire an intelligent understanding of the habitat, distribution, and life history of the different animals. The following list of 119 species of forest trees found on the Mexican Boundary is not inclusive of those peculiar to the lower Rio Grande Valley:

LIST OF TREES OF THE MEXICAN BOUNDARY LINE.

PINUS STROBIFORMIS Engelmann.

MEXICAN WHITE PINE.

This tree was found at the summits of the main peaks of the San Luis Mountains, south of the Boundary Line (altitude 2,400 meters, or 7,874 feet). It was also found on the Animas Peaks (altitude 2,677 meters or 8,783 feet) in New Mexico. In the San José Mountains (altitude 2,541 meters or 8,337 feet), Sonora, a few trees were found close to the summit of the main peak. It is a common tree on the highest peaks of the Huachuca Mountains, where it occupies considerable area, descending, in Millers Canyon, as low as 2,027 meters (6,650 feet). The Mexican white pine is a tree of the Canadian life zone, and does not descend as low as the Douglas spruce. In its range it is usually associated with the Douglas spruce, aspen, and Gambel oak. It is a tree from 10 to 30 meters (30 to 100 feet) in height, bearing long, resinous cones, whose seeds are attractive to squirrels.

PINUS CEMBROIDES Zuccarini.

MEXICAN PIÑON.

This nut pine was first met with on the Big Hatchet Mountain (altitude 2,545 meters or 8,350 feet), about 110 miles west of the Rio Grande, in Grant County, New Mexico. It is the principal tree, and the only pine, of this mountain, covering most of the north and east slopes above 6,000 feet. There are a few isolated trees in the Dog Mountains. It also reaches to the summit of the San Luis Mountains (altitude 2,400 meters or 7,874 feet), which it descends to the level of 1,826 meters (5,990 feet); but though not uncommon in mountains to the westward, it was nowhere the dominant tree except on Big Hatchet Mountain. Its range extends westward to the Pajaritos Mountains, and is the only pine found west of the Santa Cruz Valley, until the mountains of the Coast Range, in California, are reached. On the San José, Huachuca, and Patagonia mountains its range extends from 1,829 meters (6,000 feet) upward. The Mexican piñon has, apparently, a higher altitudinal range than *Pinus edulis*, having been found by us at a little less than 2,740 meters (9,000 feet) above sea level on the Huachuca Mountains.

PINUS EDULIS Engelmann.

PIÑON.

Specimens of this pine were brought to the author at Fort Clark, Texas, by hunting parties sent out to the mountains northwest of the post. The species was not met with elsewhere on the Boundary, though its range extends from western Texas across New Mexico into northeastern Arizona, in which region it, together with the red juniper, marks the limits of the Upper Sonoran Life Zone.

PINUS MONOPHYLLA Torrey and Fremont.

SINGLE LEAF PIÑON.

Specimens of this pine were collected in the highest notches of the Coast Range Mountains of California, near the Boundary. It does not occur on the Mexican line east of the Colorado Desert; but in 1884 I saw an extensive forest of what I suppose to have been this species occupying a zone between the Santa Fe Pacific Railroad and the Colorado River east of Peach Springs, in Arizona.

PINUS TORREYANA Parry.

TORREY PINE.

This pine is confined to certain of the Santa Barbara Islands, off the coast of southern California, and to a small area on the mainland a few miles north of San Diego Bay.

PINUS ARIZONICA Engelmann.

ARIZONA PINE.

I found this tree on the north side of the San José Mountains, Sonora, between 2,130 and 2,440 meters (7,000 to 8,000 feet) altitude, occupying the lower portion of the *Pinus ponderosa* zone. It appears to have the same range on the east side of the Huachuca Mountains, where, in company with Maj. Timothy E. Wilcox, I collected specimens on the peak known as Nigger Head, at 2,160 meters (7,100 feet), in July, 1893. It also occurs in the same zone on the Chiricahua and Mogollon mountains of Arizona. The specimens from San José Mountains were identified by Prof. Charles S. Sargent.

PINUS PONDEROSA Lawson.

BULL PINE.

In proceeding westward the bull pine was first seen on the summit of Animas Peak (altitude 2,677 meters, or 8,783 feet), in southwestern New Mexico. It was subsequently found in abundance on the San José Mountains, in Sonora, and in the Huachucas of Arizona, where it ranges from 2,130 meters (7,000 feet) upward. Specimens from each of the above localities were identified by Prof. Charles S. Sargent. This handsome pine (Plate III, fig. 1) is from 25 to 50 meters (80 to 165 feet) in height. It marks the extent of the so-called Transition Life Zone, which in the east is occupied by the Alleghanian fauna. On the Mexican line its ascertained vertical range is from 1,890 meters, or 6,200 feet (San José Mountains, Sonora), up to 2,590 meters, or 8,500 feet (Huachuca Mountains, Arizona).

PINUS MAYRIANA Sudworth.

MAYR PINE; ARIZONA BROAD LEAF PINE.

This stately tree grows rather sparingly on both sides of the San Luis range of mountains, from the highest slopes down, in canyons only, to the base of the mountains. Specimens from these mountains were identified by Prof. Charles S. Sargent. Maj. Timothy E. Wilcox collected specimens of the Mayr pine in the Huachuca Mountains, which were included in the list prepared by Messrs. Britton and Kearney.

1. Pinus Ponderosa (See Page 38).
2. West Foot of San Luis Mountains (See Page 90).

PINUS CHIHUAHUANA Engelmann.

CHIHUAHUA PINE.

This is a medium-sized pine, about the size of *Pinus rigida* of the eastern United States. Its range is lower than that of *Pinus ponderosa*, *P. mayriana*, or even *P. arizonica*, but slightly higher than the piñon. Specimens were collected on both sides of the San Luis Range, and on the Guadalupe, San José, and Huachuca mountains. On the east slope of the San Luis Mountains it was found from 1,850 to 2,070 meters (6,080 to 6,800 feet). On the west slope it was found as low as 1,815 meters (5,950 feet). At the point where the Boundary Line crosses the San Luis Mountains, this species ranges in altitude on the east side from 1,850 to 2,075 meters (6,075 to 6,800 feet). In Millers Canyon of the Huachuca Mountains the range of this species begins at 1,830 meters (6,000 feet), at which point *Acer saccharum grandidentatum* and *Pseudotsuga mucronata* also begin, in the creek bed. On the northeast side of the San José Mountains, above Gallina Spring, the Chihuahua pine begins at 1,960 meters (6,425 feet) and extends up to 2,110 meters (6,925 feet).

PINUS SABINIANA Douglas.

SABINE PINE; GRAY PINE.

This is the common pine of the Coast Range of California, where it replaces *P. ponderosa* of the interior; and, like that species, it is a tree of the Transition Zone. Pine Valley, a basin nestling among the foothills of the Laguna Mountains, east of San Diego, is wooded with the Sabine pine. The altitude of this valley is about 1,300 meters (4,300 feet). The seeds of the large cones are much sought by squirrels and birds.

PINUS COULTERI Lambert.

COULTER PINE; BIG CONE PINE.

This remarkable pine, which bears cones of enormous size, was found only along the crest of the Laguna Mountains, a spur of the Coast Range, in California. Its range appeared to be restricted to a narrow belt close to the summit on the desert (east) side of the mountains, a few trees straggling into the highest notches.

PSEUDOTSUGA MUCRONATA (Rafinesque) Sudworth.

DOUGLAS SPRUCE; RED FIR.

This was the most abundant tree of the Canadian or Lower Boreal Life Zone on the San Luis, Animas, and Huachuca mountains, on all of which it reaches the summits. In cold, wet ravines it sometimes extends down to 1,830 meters (6,000 feet) altitude. It was not found on any other mountains of the boundary strip. I looked for it in vain on the San José Mountains, where, in the upper zone, occupied by the Gambel oak, Mexican white pine, and aspen, it is replaced by the white fir. In ascending the San Luis Mountains by way of Turkey Canyon, the first Douglas spruce is reached at 1,860 meters (6,100 feet); the next at 1,890 meters (6,200 feet). In Millers Canyon of the Huachuca Mountains this spruce begins at 1,830 meters (6,000 feet), which is the lowest point at which it was noted. In both of these mountains the lowest Douglas spruces were found associated with *Pinus chihuahuana* and *Acer saccharum grandidentatum*. In 1887, I measured one of these trees in the camp at Little Springs, at the north base of San Francisco Mountains (altitude 2,500 meters, or 8,250 feet), and found it to be 3.3 meters (10.8 feet) in circumference and 33.5 meters (110 feet) in height.

ABIES CONCOLOR (Gordon) Parry.

WHITE FIR.

This tree is very rare in the Huachuca Mountains. A few were also found in the San José Mountains. A specimen from the last place was identified by Prof. Charles. S. Sargent. It was not found elsewhere on the Mexican Boundary Line, but is common in several localities along the Grand Canyon of the Colorado, in northern Arizona.

TAXODIUM DISTICHUM (Linnæus) Richard.

BALD CYPRESS.

The range of the bald cypress includes the lower Rio Grande valley. In traveling east on the Southern Pacific Railroad it is first seen at Sabinal, Texas. It extends far up the valley of the Nueces, a few trees having been found between the Nueces and Devils rivers.

LIBOCEDRUS DECURRENS Torrey.

INCENSE CEDAR.

We found a few of these trees on the Laguna Mountains of the Coast Range, near Campbell's Ranch, at the altitude of about 1,525 meters (5,000 feet). Sargent states that this magnificent tree reaches 100 to 150 feet in height and 7 to 8 feet in diameter of trunk.

CUPRESSUS GOVENIANA Gordon.

GOWEN CYPRESS.

This cypress was only found in the Jamul Valley, between El Nido and Dulzura, in San Diego County, California.

CUPRESSUS ARIZONICA Greene.

ARIZONA CYPRESS.

This species of cypress is abundant on both sides of the San Luis Mountains and on the Animas Mountains north of them. It was not seen elsewhere on the Boundary, though careful search was made for it on the San José and Huachuca mountains. In Yavapai County, Arizona, it forms brakes which cover extensive areas on the hill slopes bordering the headwaters of the Verde River, notably on Pine and Oak creeks. In the San Francisco Canyon, on the east side of the San Luis Mountains, in Chihuahua, this tree was found as low as 1,720 meters (5,650 feet) altitude. In Turkey Canyon, on the west side of the San Luis Mountains, it was not seen lower than 1,780 meters (5,850 feet). It reaches the summit of these mountains. It is a handsome tree with reddish bark, 12 to 40 meters (40 to 125 feet) in height and .3 to 1 meter (1 to 3 feet) in diameter.

JUNIPERUS MONOSPERMA (Engelmann) Sargent.

ONE SEED JUNIPER.

This juniper belongs to the upper Sonoran Life Zone. The extreme vertical range of this species, as determined by me on the Boundary, is from 1,260 to 1,868 meters (4,134 to 6,129 feet).

The first juniper was met with on the rocky rim of a volcanic crater south of Monuments Nos. 8 and 9 of the Mexican Boundary Line. Only two trees were seen at this place, which has an altitude of 1,260 meters (4,134 feet). We did not meet with junipers again until the Carrizalillo Mountains were reached. These mountains rise from 1,270 to 2,295 meters (4,167 to 7,530 feet), and are sparsely wooded with this juniper, which is also common in the Apache Mountains around Monument No. 40 (altitude of monument, 1,494 meters, or 4,902 feet). The "cedar" was also common on the Big and Little Hatchet and Dog mountains in Grant County, New Mexico. On the Dog Mountains the one-seed juniper ranges from 1,500 to 1,868 meters (4,922 to 6,129 feet), its range being about coëxtensive with that of *Quercus emoryi*, practically ending with that species at 1,753 meters (5,750 feet) altitude, though a few trees straggle to the summit.

This tree was not seen on the east or west side of the San Luis Mountains, because the base-level is too high; but it was common on the southern and southwestern slopes of these mountains, in the Mexican notch between the Sierra Madré and San Luis ranges.

In Guadalupe Canyon the highest tree was at the altitude of 1,676 meters (5,500 feet), the lowest in the neighboring San Bernardino Valley to the westward being at 1,280 meters (4,200 feet).

The one-seed juniper is uncommon to the westward of the Perrilla Mountains. A few were seen on the east slope of the Mule Mountains at the western border of the Sulphur Spring Valley. We did not see this tree on the San José or Huachuca mountains, though a few are known to exist at the base of latter, the species being included in the list of plants collected in the Huachuca Mountains by Maj. Timothy E. Wilcox.

This is usually a rather scragged tree, from 5 to 10 meters (16 to 35 feet) high; but in the damp canyons at the head of the Yaqui River it grows larger, and has slender branches and a drooping habit of growth.

JUNIPERUS CALIFORNICA Carrière.

CALIFORNIA JUNIPER.

This is a rather scrubby tree, bearing remarkably large fruit. (See Plate IV, fig. 1.) It was only found on the Coast Range of California, where it descends to the level of Mountain Spring on the east slope (altitude 775 meters, or 2,543 feet).

JUNIPERUS PACHYPHLŒA Torrey.

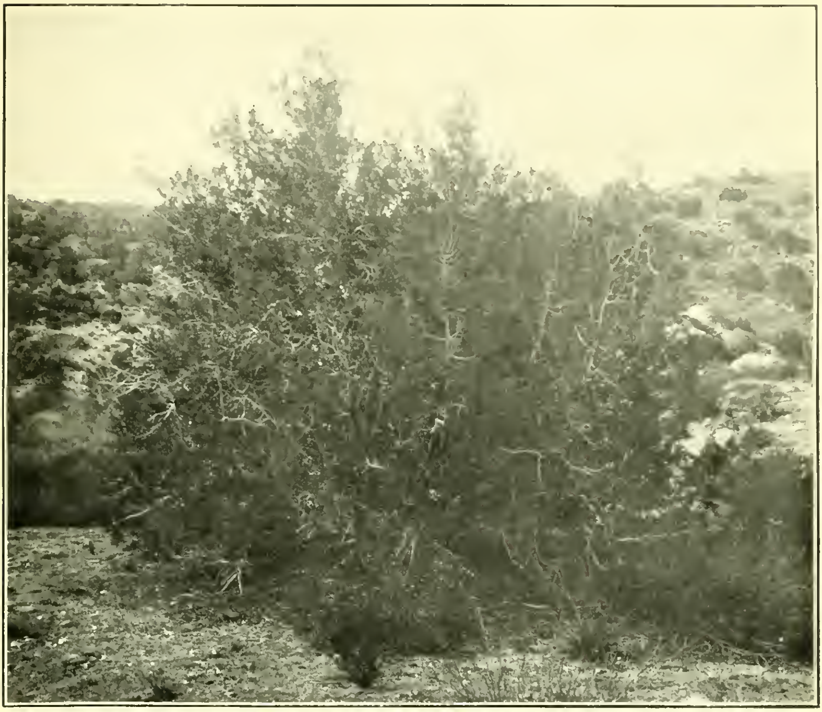
ALLIGATOR JUNIPER.

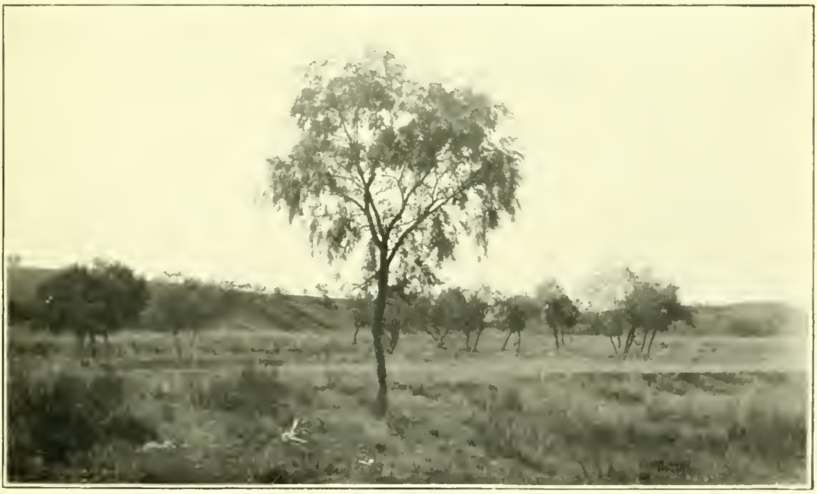
This is the common species of juniper of the mountains of the interior, along the Mexican Boundary Line. It was found on the Big Hatchet, Dog, San Luis, and Animas mountains, all in Grant County, New Mexico. It is also common on the opposite side of the International Line, in the San Luis and Guadalupe mountains of northwestern Chihuahua and northeastern Sonora. Farther west it was likewise abundant in the Mule, San José, Huachuca, Patagonia, and Pajaritos mountains.

The extreme vertical range of the alligator juniper, as determined on the Mexican border region, is from 1,355 to 2,545 meters (4,446 to 8,350 feet). It was found at the highest summits of the Big Hatchet, Dog, San Luis, Animas, and Patagonia mountains.

On the Dog Mountains in New Mexico the regular juniper zone on the mountain slopes extends from 1,829 meters (6,000 feet) up to the summits; but in moist canyons it descends to the very base of these mountains. On the Boundary Line, south of the Dog Mountains, near Monument No. 55, are several fine alligator junipers at the altitude of 1,475 meters (4,839 feet).

On the west side of the San Luis Mountains, in Turkey Canyon, the lowest tree of this species stands in a grove of Emery oaks, close to the lower limit of timber, at 1,684 meters (5,525 feet). No others were seen in this canyon until at 1,737 meters (5,700 feet), a well-marked juniper zone was reached. As stated, its range extends to the summit (2,400 meters, or 7,874 feet). The largest tree





1. Juniperus Californica (See Page 42).
2. Salix Taxifolia (See Page 46).

seen by us in the San Luis Mountains, in the lower part of Turkey Canyon, measured 2.75 meters (9 feet) in circumference and 18 meters (60 feet) in height.

There are some particularly fine examples of the alligator juniper in canyons on the north side of the San José Mountains in Sonora, south of Monument No. 93 of the Mexican Boundary Line. The largest of these, growing at 2,077 meters (6,815 feet) altitude, measured 4.5 meters (15 feet) in circumference and about 18 meters (60 feet) in height.

On the Patagonia Mountains the alligator juniper ranges from the edge of the Santa Cruz River, at the Mexican town of Santa Cruz (altitude 1,355 meters, or 4,446 feet), up to the summit (2,217 meters, or 7,274 feet).

Birds and squirrels, especially the chipmunk, are fond of the fruit of this tree.

NEOWASHINGTONIA FILAMENTOSA (Wendland) Sudworth.

FANLEAF PALM; DESERT PALM.

This, the largest of the palms of the United States, forms isolated groves along the western border of the Colorado Desert, in southern and Lower California, extending well up into many of the moist canyons at the eastern base of the Coast Range Mountains. The "Palm Tract" marks the extension of the Lower Californian tropical flora into the United States.

YUCCA TRECULEANA Carrière.

TEXAS SPANISH BAYONET.

This coarse, long-leaved yucca was only observed about Las Moras Mountain, and in other parts of Kinney County, Texas.

YUCCA BREVIFOLIA Torrey.

SCHOTT YUCCA.

This species was found in canyons of the mountains of southern New Mexico and Arizona, and the northern part of Chihuahua and Sonora. It was found from the lower timber line to the summit of the San Luis Mountains, and in all the canyons at the head of the Yaqui River in the vicinity of the Boundary. Specimens were collected in the Huachuca Mountains, Arizona; and it also occurs in the San José Mountains, Sonora. The large fruit is edible.

YUCCA RADIOSA Trelease. (*Yucca constricta* Buckley.)

DESERT YUCCA.

This tall, branching yucca was the only tree of the deserts between the Rio Grande and the San Luis Mountains. In the 50-mile desert west of El Paso open forests of this species spread over large areas of country. The largest trees were 5 meters (16.4 feet) in height, and were often much branched. Its range on the Boundary, west of El Paso, is between Monuments Nos. 1 and 64. (See Plate V, fig. 1.)

YUCCA MACROCARPA (Torrey) Coville.

LARGEFRUIT YUCCA.

This is the tree yucca of canyons in southwestern Texas.

YUCCA MOHAVENSIS Sargent.

MOHAVE YUCCA.

This species was found in the coast region west of the Colorado Desert.

NOLINA BIGELOVII Watson.

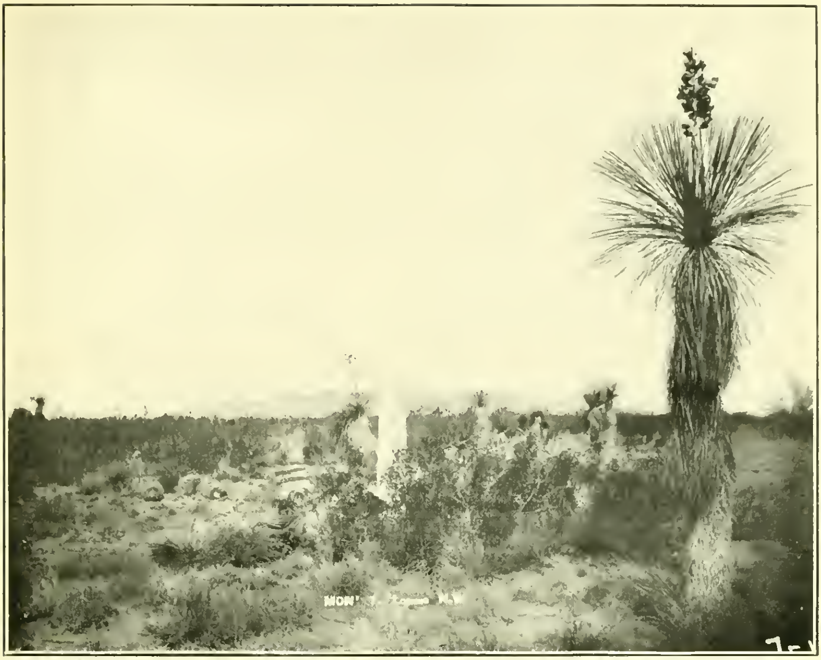
BIGELOW NOLINA.

This species was found in all of the narrow desert ranges from the Tule to the Gila Mountains, east of the Colorado River. The largest individual seen was near a spring or tank of water in a canyon of a hitherto nameless range of mountains between the Tule and Lechuguilla ranges, but a little farther north, wholly in Arizona, which I have designated as the Granite Mountains. This example was about 3 meters in circumference of the naked caudex, and 8 meters in height. Other specimens seen in the Gila Mountains were nearly or quite as large, and not infrequently divided above into several branches. The size of this plant, as usually quoted from the label of Schott's type specimen ("Stem 6 feet high and 2 to 3 feet in diameter"), is quite misleading; and botanists are surprised to find it a tree of goodly dimensions—larger, in fact, than any yucca of the boundary region.

JUGLANS RUPESTRIS Engelmann.

WESTERN WALNUT.

The range of the walnut, on the Boundary Line, extends from the Dog Mountains (Monument No. 55) to the Pajaritos Mountains, perhaps as far as Monument No. 138. Specimens were collected at Dog Spring and Cloverdale, New Mexico; on Cajon Bonito Creek, Chihuahua; in the San José, Santa Cruz, and Pajaritos mountains, Sonora, and in the Mule, Huachuca, and Patagonia mountains, and on the San Pedro River, in Arizona. The species is also of common occurrence on the headwaters of the Verde River, in central Arizona. The town of Nogales received its name from the grove of walnuts which occupied the present site of the city at the time of the old survey of the Mexican Boundary under Major Emory. There are still many fine walnuts in the vicinity of the town and along the neighboring Santa Cruz River. One of these trees, of which Mr. D. R. Payne,



1. Yucca Radiosa (See Page 44).
2. Quercus gambelii (See Page 50).

the photographer of the International Boundary Commission, obtained an excellent photograph, measured 2.34 meters in circumference, and was estimated to be from 12 to 15 meters in height. This tree was on the bank of the Santa Cruz River, a few miles above Monument No. 118, at an altitude of about 1,300 meters (4,300 feet).

On the San José Mountains the largest walnut tree seen was about 1.5 meters in circumference and 12 meters in height. This tree grew beside a small spring at 2,210 meters (7,250 feet) altitude. At 2,240 meters (7,350 feet) there were several trees about a meter in circumference and 10 meters in height. The highest one, a small tree, grew at the altitude of 2,255 meters (7,400 feet).

The lowest walnut tree in Turkey Canyon, on the west side of the San Luis Mountains, is at 1,700 meters (5,575 feet). On the east side of the San Luis Mountains, in the foothills near White Water, a tree was found at 1,654 meters (5,425 feet). In the canyons of the Mule Mountains, in Arizona, walnuts are numerous, extending downward as far as Monument No. 90 (altitude 1,390 meters, or 4,561 feet).

HICORIA PECAN (Marshall) Britton.

PECAN.

This, one of the largest, most beautiful, and most valuable trees in western Texas, is found east of Devils River, on which stream it also occurs. It is one of the most abundant trees along streams in the vicinity of Fort Clark, Texas.

SALIX NIGRA Marshall.

BLACK WILLOW.

This is a common willow along streams everywhere in the Southwest, though it is least abundant in the California section of the Boundary Line. I do not remember a stream of New Mexico or Arizona that lacks it. Its vertical range was not determined accurately, owing to the difficulty of following up the streams, to which its habitat is restricted. It was usually found as far up as there were any fish. On the Pacific slope of the Coast Range it was collected in the zone of *Pinus sabiniana*, at 4,300 feet (1,310 meters) altitude. It is usually a small or medium-sized tree, with rough gray bark. The largest ones seen were about .6 meter (2 feet) in diameter and 18 meters (60 feet) in height.

SALIX OCCIDENTALIS LONGIPES (Andersson) Bebb.

LONGSTALK WILLOW.

This is a small tree, from 20 to 40 feet (6 to 12 meters) in height, found in wet soil in the mountains of the Elevated Central Tract. On the Boundary it was common in all suitable places from the Dog

Mountains of New Mexico west to the Pajaritos Mountains of Arizona and Sonora. It is a pretty tree, with brittle branches and thick leaves which are pale and glaucous on the under surface. In young trees the bark is smooth and greenish. The longstalk willow often grows with *Salix nigra*. On the streams of Chihuahua and Sonora the two were often seen side by side.

SALIX AMYGDALOIDES Andersson.

ALMONDLEAF WILLOW.

This is the commonest willow of the Rio Grande from El Paso to Fort Hancock, Texas, where it forms thickets on the islands and low banks of the stream.

SALIX LÆVIGATA Bebb.

SMOOTHLEAF WILLOW.

This is a large, handsome tree, with rough, blackish bark and glossy leaves. It is a common species on the banks of streams which flow into the Pacific Ocean. It was only found west of the Coast Range Mountains.

SALIX FLUVIATILIS Nuttall.

LONGLEAF WILLOW.

The longleaf willow is a common tree along the Colorado River from the Gila to the Gulf of California, flowering in April. On the Salton and New rivers—branches of the Colorado—of the Western Desert, it was the most abundant tree. It was also found at Jacumba Hot Springs, on the Pacific slope of the Coast Range, opposite a deep notch in those mountains through which several desert plants and animals have reached the west side. This is usually a smaller tree than the black willow (*Salix nigra*).

SALIX ARGOPHYLLA Nuttall.

CANESCENT WILLOW.

This silky-leaved willow appears to be very distinct from *Salix fluviatilis*. It was found on the east side of the Coast Range Mountains, in California and Lower California.

SALIX TAXIFOLIA Humboldt, Bonpland, and Kunth.

YEWLEAF WILLOW.

This is a beautiful little tree, usually not more than .15 to .3 meters in diameter and 5 to 6 meters (15 to 20 feet) in height. (See Plate IV, fig. 2. The bark is flaky, light gray, and rough. This species can exist in drier soil than any other willow of the region, and will grow wherever a mesquite could find sufficient moisture. We found it from the head of Cajon Bonito Creek, in the San Luis Mountains, west to the Santa Cruz Valley. The lowest point was in Sonora, near the junction of Cajon Creek with the San Bernardino River (altitude 3,199 feet, or 975 meters); the highest, near the head of Babocomeri Creek, in Arizona (altitude 5,320 feet, or 1,621 meters).

SALIX LASIOLEPIS Bentham.

BIGELOW WILLOW.

This willow is abundant on the Pacific slope of the Coast Range Mountains, in California and Lower California. To the eastward we obtained it only on the Huachuca Mountains, Arizona.

SALIX NUTTALLII Sargent.

NUTTALL WILLOW.

This is an alpine species, growing near the summits of the Mogollon and San Francisco mountains, in central Arizona, and on San José Mountain, in Sonora, Mexico.[a]

POPULUS TREMULOIDES Michaux.

ASPEN; QUAKING ASP.

Aspens were found only on the summits of the Animas, San José, and Huachuca mountains, where they belong to the highest or Boreal zone, and are associated with *Quercus chrysolepis*, *Q. gambelii*, *Pinus strobiformis*, and *Pseudotsuga mucronata*. Its vertical range, on the Mexican Line, is from 1,343 meters or 7,690 feet (San José Mountain Sonora, Mexico) to 2,887 meters or 9,472 feet (summit of Huachuca Mountains, Arizona). The largest aspens were those on the Huachuca peaks; but none of those seen on the Mexican Line were comparable in size with the aspens of northeastern Arizona. At Little Spring, at the north base of San Francisco Mountain, Arizona (altitude 2,500 meters or 8,250 feet), I measured an aspen that was 1.72 meters (5.64 feet) in circumference and 21.3 meters (70 feet) in height.

POPULUS ANGUSTIFOLIA James.

NARROWLEAF COTTONWOOD.

This handsome cottonwood was collected at one or two places in Grant County, New Mexico, in the vicinity of springs, where it may have been artificially planted. It is a common tree in Tonto Basin, Arizona. I had previously collected it on Fossil, Corduroy, and Carriza creeks, in central Arizona.

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[a] Another willow, which I am unable to determine, is abundant in moist valleys near the summit of the Coast Range, in California. This is a scrubby tree from 2 to 6 meters (6 to 20 feet) in height.

POPULUS FREMONTII Watson.[a]

FREMONT COTTONWOOD.

No tree is more common, more beautiful, nor more valuable as a shade tree than the cottonwood. It grows naturally on almost every stream along the Boundary, and is planted around the houses and along the irrigation "acequias" of nearly every ranch. In California it is less abundant than in Arizona, New Mexico, and Texas, but was found on the Salton River[b] of the Colorado Desert, at Mountain Spring, on the east side of the Coast Range, and on Jamul Creek, near the Pacific Ocean.

The habit of the cottonwood, of course, varies according to environment. In deep, narrow canyons, where it reaches upward toward the light, its stem is very tall and slender, as is also the case where the tree growth is close and crowded along the streams; but, in open spaces, trees growing singly have full round tops with spreading or often drooping branches, affording grateful shade to man and beast and a home to many species of birds. Probably the largest cottonwoods grow on the upper course of the Yaqui River, in Mexico, but these I have not seen. Respecting a very large cottonwood, seen in central Arizona by Dr. Paul Clendenin and myself, I find the following record in my note book of 1885:

> When we reached the Agua Fria we halted for a noon rest in a grove of remarkably large cottonwoods. We measured the largest tree with a tape-line, taking the measurement at a point 4 feet above the ground. It was 34 feet in circumference and had no excrescences or morbid growths at that part, the trunk being symmetrical and rather tall, although the branches, which are very long and drooping, almost reach to the ground.

The height of this tree—probably the largest I ever saw—was not indicated in the notes. From memory I should judge it to be about 23 meters (75 feet), though it may have been more. A very handsome cottonwood that was photographed at my request by the Commission's photographer grew beside the Santa Cruz River, in Sonora, at 4,300 feet (1,311 meters) altitude. It measured 16 feet (5 meters) in circumference and 80 feet (24 meters) in height. (See Plate VI, fig. 1.)

The cottonwood's vertical range is from near sea level (Jamul Creek, California) to 6,100 feet (Huachuca Mountains, near Fort Huachuca).

The leaves are shed in autumn or early winter, and are again assumed some time from February to April, the dates varying with the altitude. Traveling from Fort Verde, in central Arizona, to Phoenix, Arizona, in 1885, it was noted that but few cottonwoods in

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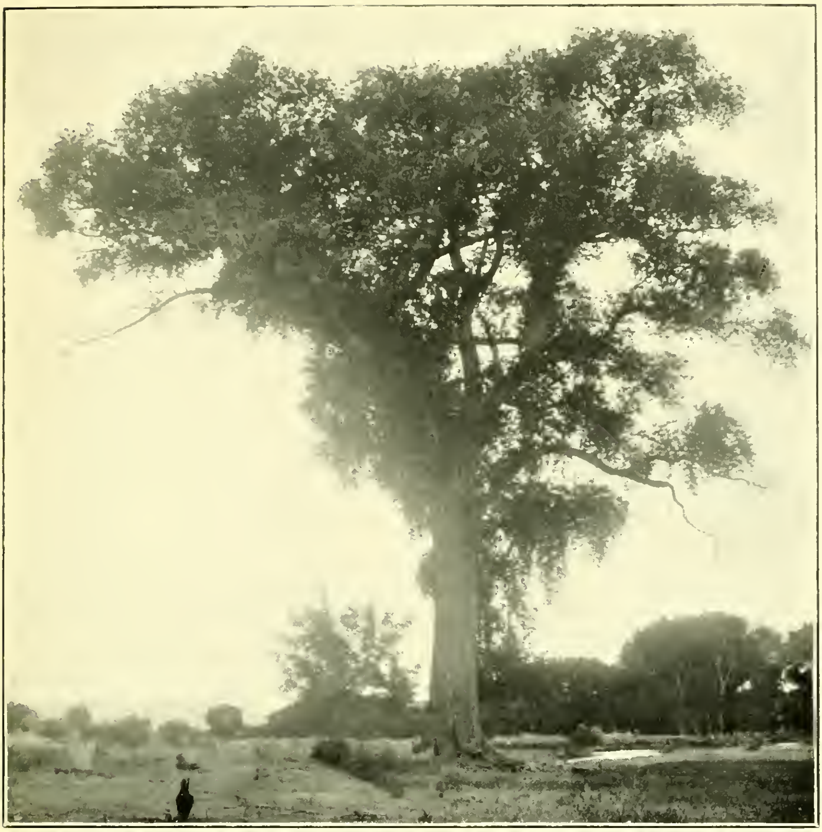
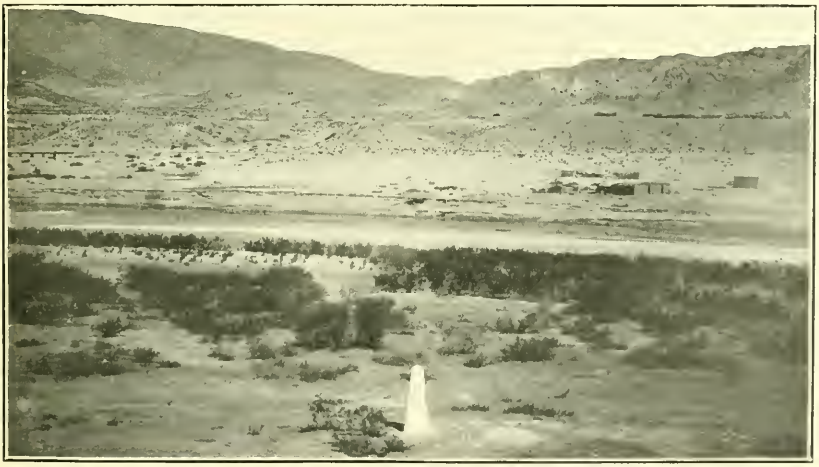
[a] *Populus wislizeni* (Watson) Sargent is the species of the upper Rio Grande.

[b] Dr. J. N. Rose considers the Salton River tree an undescribed species.





1. Populus fremontii (See Page 48).
2. Across the Rio Grande River (See Page 80).

the Verde Valley showed any foliage by March 25; but on descending to Ash Creek, March 26, we found a beautiful grove of cottonwoods in full foliage; and March 27, on reaching New River, the foliage of the cottonwood here, and farther on along New River near its junction with the Agua Fria, had assumed the dark, rich tint of green, characteristic of the fully developed leaf. The trees were feathery with "cotton," which hung in festoons from the drooping branches. I gathered a quantity of it at Huston's Ranch for stuffing and packing specimens.

ALNUS OREGONA Nuttall.

RED ALDER.

Small trees were found on the San Diego River in California. Alders were not seen elsewhere on the Mexican Boundary, but on the headwaters of the Verde River, in central Arizona, *Alnus acuminata* grows commonly along streams, and has the proportions of a medium-sized tree.

QUERCUS GAMBELII Nuttall.

GAMBEL OAK.

This is a deciduous white oak, growing only at or near the summits of the higher mountains. It occupies the Canadian or lowest division of the Boreal Zone, and is often associated with the Mexican white pine, Douglas spruce, and aspen. In good soil it reaches a height of 20 to 60 feet, with a trunk from 1 to 3 feet in diameter. Some trees seen on the Mogollon Mountains, Arizona, probably exceeded these dimensions. At the base of San Francisco Mountain, near Flagstaff, Arizona, in 1886 and 1887, I camped in a handsome grove of these trees, which had long ago excited the admiration of the members of Captain Sitgreaves's party, but which was overlooked by Dr. C. Hart Merriam, who observed:[a]

> There is something remarkable respecting the history of this tree in the San Francisco Mountain region. Sitgreaves and other early explorers speak of it as abundant about the mountain, while we did not find it at all in the very places where it was formerly common. Its absence explains the absence of several species of birds which might be expected at the mountain, but which are rarely found except in oak scrub.

On the higher peaks of the Mexican Boundary region this oak usually becomes reduced to a scrubby bush from 2 to 4 feet in height; but on the Animas Mountains, close to the summit of next to the highest peak of the range, a tree was seen which was 2 feet in diameter and 30 feet in height, with rough, whitish bark, resembling that of the eastern white oak (*Quercus alba*). Large examples of this tree are scarce on the San Luis Mountains; and few were seen that reached 25 feet in height on the San José Mountains; but large trees were frequently seen in the Huachuca Mountains. (Plate V, fig. 2.)

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[a] North American Fauna, No. 3, p. 119, September 11, 1890.

Its vertical range on the San Luis Mountains is from 2,204 meters (7,230 feet) to the summit, or 2,400 meters (7,874 feet); on the San José Mountains, from 2,085 meters (6,840 feet) to the summit (2,541 meters, or 8,337 feet); and on the Huachuca Mountains, from 2,133 meters (7,000 feet) to the summit (2,887 meters, or 9,472 feet). The two largest specimens seen on the San José Mountains measured, respectively, 2½ feet in diameter and 30 feet in height (altitude 7,150 feet), and 2 by 60 feet (altitude 7,250 feet; beside a spring).

QUERCUS BREVILOBA (Torrey) Sargent.

DURAND OAK.

This is a large evergreen oak, abundant along the streams of Texas as far west as Devils River. It usually leans toward the streams along which it grows, the branches frequently touching those of the opposite side. In Texas this species is the analogue of *Quercus agrifolia* in California.

QUERCUS UNDULATA Torrey.

ROCKY MOUNTAIN OAK.

This is a scrub oak, ranging from western Texas to Arizona. It is less abundant on the Mexican Boundary than farther north.

QUERCUS ENGELMANNI Greene.

ENGELMANN OAK; EVERGREEN WHITE OAK.

This is a tree of the Upper Sonoran zone, west of the Coast Range, in California and Lower California. This zone was crossed between Campo and Tecate Mountain (Monuments Nos. 240 to 245), on the Mexican Line. Farther north, between San Diego and Cuyamaca Mountain, it forms a somewhat broader zone, below the range of *Pinus sabiniana*. It is a handsome evergreen oak of medium size.

QUERCUS OBLONGIFOLIA Torrey.

OBLONGLEAF OAK; BLUE OAK.

This is the oak of the lower timber line on the mountains of the interior region, where the groves of this tree bear a general resemblance to apple orchards in the East. The leaves are small, glaucous, and evergreen. We found it on the Dog Mountains, in Guadalupe Canyon, and on the Mule, San José, Huachuca, Patagonia, and Pajaritos mountains, always forming a narrow belt at the lower general timber line. Its vertical range is from 1,266 meters, or 4,157 feet (Monument No. 73, in Guadalupe Canyon), to 1,874 meters, or

6,150 feet (near Gallina Springs, San José Mountains). Its longitudinal range, on the Mexican Line, is from the Dog Mountains to the Pajaritos Mountains (Monuments Nos. 54 to about 138). The largest tree seen measured 2.63 meters in circumference and 20 meters in height (Cloverdale, Grant County, New Mexico).

QUERCUS ARIZONICA Sargent.

ARIZONA WHITE OAK.

This oak, which in Arizona is commonly known as the white live oak, to distinguish it from *Quercus emoryi*, which is called the black live oak, is the commonest of the genus along the Mexican Border, perhaps excepting the Emory oak. It is a rather low, widely spreading tree, with the short trunk from 1 to 4 feet in diameter and 20 to 60 feet in height. As a rule this species begins just above the lower edge of timber, commencing a little higher than *Quercus oblongifolia*, with which it is associated in the lowest part of its range. Its extreme vertical range is from 1,267 meters, or 4,157 feet (Guadalupe Canyon), to 2,500 meters, or 8,200 feet (San José Mountain). Longitudinally its range coincides with that portion of the Mexican Boundary Line which is formed by the parallel of 31° 20′ (Monuments Nos. 53 to 127). We found it in the Dog, San Luis, Animas, Guadalupe, Cero Gallardo, Mule, San José, Huachuca, Santa Cruz, Patagonia, and Pajaritos mountains. It belongs to the Transition Zone.

QUERCUS RETICULATA Humboldt and Bonpland.

NETLEAF OAK.

This oak, which is remarkable for its long-stalked acorns, was only found on the San Luis, Animas, and Huachuca mountains. At the summits of these high ranges it is a shrub, but lower down it becomes a small tree with rough, whitish bark. On the west side of the San Luis Mountains, in Turkey Canyon, it descends to 1,893 meters (6,210 feet). The largest tree seen was perhaps 20 feet in height and 6 inches in diameter; but none were measured in the field.

QUERCUS TOUMEYI Sargent.

TOUMEY OAK.

This oak is about 8 to 10 meters (25 to 30 feet) in height, with a short trunk 15 to 20 dm. (6 to 8 inches) in diameter, usually dividing near the ground into several stout wide-spreading branches, which form a broad head. It occurs sparingly in the neighborhood of Monument No. 40, in Grant County, New Mexico, and abundantly in the Mule Mountains in Cochise County, in southern Arizona. It is a tree of the Upper Sonoran Zone.

QUERCUS DUMOSA Nuttall.

CALIFORNIA SCRUB OAK.

This scrubby oak was found on both sides of the Coast Range Mountains, in California, its range extending to the Pacific coast and neighboring islands of the Santa Barbara group. It belongs to the Upper Sonoran Life Zone, in some places reaching the Lower Sonoran.

QUERCUS EMORYI Torrey.

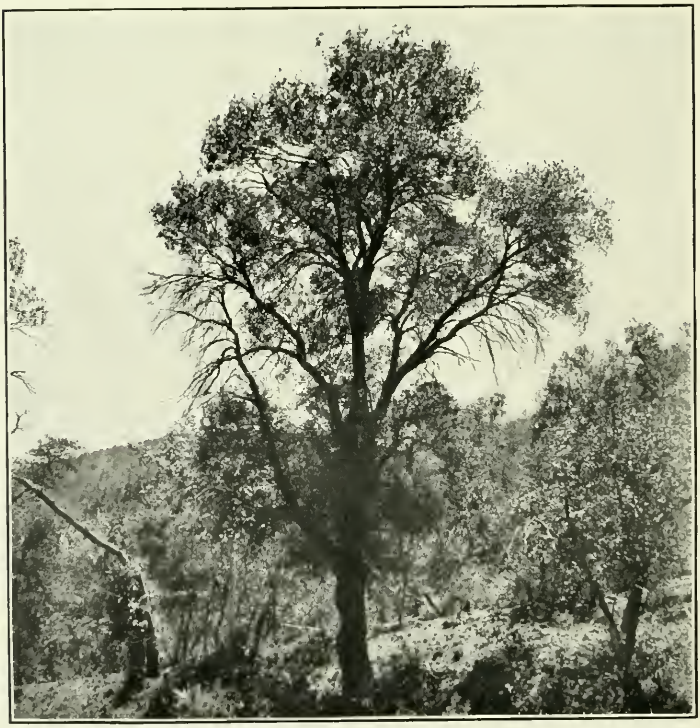
EMORY OAK.

This evergreen black oak was first met with going westward in the Dog Mountains in Grant County, New Mexico, and was common thence to La Osa (Monument No. 140), at the western extremity of the Pajaritos Mountains. With the exception of *Quercus oblongifolia*, its distribution is lower than the rest of the oaks. On the west side of the San Luis Mountains the lowest tree in prolongation of Turkey Canyon is a cherry at 1,680 meters (5,510 feet) and the second an Emory oak at 1,683 meters (5,520 feet). From this point it is common up to 6,500 feet (1,981 meters) altitude. On the east side of the San Luis Mountains, near White Water, it was found at 1,654 meters (5,425 feet) altitude. On the Dog Mountains its range extends from the base up to the altitude of 1,753 meters (5,750 feet), where it ends with the one-seed red juniper. On the San Jose Mountains, near Gallina Spring, it was found as high as 1,963 meters (6,440 feet). The Emory oak is the most common and the most valuable tree of its genus in Arizona. Its acorns are sweet and toothsome, its foliage glossy and beautiful, and its trunk tall and straight. It occurs in the upper Sonoran Zone, but seldom penetrates the Transition Zone. The finest specimens grow in valleys, usually near streams. The largest ones seen along the Boundary were in the Pajaritos Mountains. Some of these were nearly 30 meters (100 feet) in height and about 1 meter (3 to 4 feet) in diameter.

QUERCUS CHRYSOLEPIS Liebmann.

CANYON LIVE OAK.

This is an evergreen shrub on the tops of the highest mountains of the Elevated Central Tract, becoming a small tree lower down on the slopes of these mountains. The leaves are small, coriaceous, and glossy; sometimes entire, but the young shoots usually bear spine-angled leaves which resemble those of the holly. On Nigger Head peak of the Huachuca Mountains its range extends from the altitude of 1,951 meters (6,400 feet) upward. Specimens were taken at 6,400 feet from a tree 2 feet in diameter and 25 feet in height. At



1. Quercus agrifolia (See Page 53).
2. Quercus hypoleuca (See Page 53).

2,133 meters (7,000 feet) this oak was reduced to a shrub, having spiny angled instead of mostly entire leaves.

On the San Luis Mountains this tree was not met with on the main ridge north of Turkey Canyon below the altitude of 2,240 meters (7,340 feet), and only spiny-leaved shrubs were seen; but in Turkey Canyon trees were found as low as 2,133 meters (7,000 feet), having mostly entire leaves and ranging from 6 to 9 meters (20 to 30 feet) in height. The bark is usually rather smooth and blackish gray. The acorn cups are very characteristic.

In the Canelo Hills, between the Huachuca Mountains and the Santa Cruz River, two handsome trees were seen. It was also found on the highest peaks of the Coast Range Mountains, in California.

QUERCUS AGRIFOLIA Née.

CALIFORNIA LIVE OAK.

A tall, handsome tree, bearing boat-shaped evergreen leaves. It is the common oak tree of the low valleys of the Pacific Coast Tract. We did not observe it on the east slope of the Coast Range Mountains, though it appeared as soon as the divide was crossed, in the vicinity of Jacumba Hot Springs. It again disappeared in the low country bordering the Pacific Ocean, where it is replaced by the scrub oak (*Quercus dumosa*). In San Diego County, California, this tree sometimes reaches the height of 23 to 30 meters (75 to 100 feet), with the trunk 0.5 to 1.5 meters (2 to 5 feet) in diameter. (Plate VII, fig. 1.)

QUERCUS HYPOLEUCA Engelmann.

WHITELEAF OAK.

A handsome evergreen oak, with medium-sized leathery leaves covered on the under surface with whitish tomentum. It is usually a small or medium-sized tree, but near the lower spring in Turkey Canyon of the San Luis Mountain are several trees that reach nearly 30 meters (100 feet) in height, with straight trunks 1 meter (about 3 feet) in diameter. At the highest spring on the north side of the San José Mountains at 2,297 meters (7,250 feet) altitude is a whiteleaf oak measuring 23 meters (75 feet) in height by 0.67 meter (2 feet) in diameter. (Plate VII, fig. 2.)

The extreme vertical range of this oak is from 1,775 meters or 5,825 feet (Turkey Canyon, San Luis Mountains, Chihuahua) to 2,877 meters or 9,410 feet (summit of Animas Peak, New Mexico). As in the case of other species of oak, it becomes a shrub on the mountain summits. On the east side of the San Luis Mountains the lowest were noted at 1,865 meters (6,120 feet); on the west side at 1,775 meters (5,825 feet). In Millers Canyon of the Huachuca

Mountains it begins, below, at 1,829 meters (6,000 feet) along with the maple (*Acer saccharum grandidentatum*).

The whiteleaf oak was found only on the Animas, San Luis, Guadalupe, San José, and Huachuca mountains.

QUERCUS WISLIZENI A. de Candolle.

HIGHLAND LIVE OAK.

A small tree, which we found only about the summits of the Laguna Mountains of the Coast Range in California. It is readily distinguished from *Quercus chrysolepis* by its very different fruit.

QUERCUS TEXANA Buckley.

TEXAS RED OAK.

This is the red oak, or Spanish oak, of Texas; found sparingly at Fort Clark, Kinney County, Texas, and abundantly on the hills to the northeast of that place. Specimens were identified by Mr. George B. Sudworth, dendrologist of the Forest Service.

QUERCUS CALIFORNICA (Torrey) Cooper.

CALIFORNIA BLACK OAK.

A large, handsome oak, growing with the Sabine and Coulter pines, in the higher portions of the Laguna Mountains in the Coast Range of California. The acorns, which are large, are an important article of diet with the Indians of the region, in whose huts we saw large sacks of them. We were also informed that during hard times, when the ground was deeply covered with snow and the Indians threatened with famine, they were sometimes obliged to chop down the pines in order to obtain the acorns, which woodpeckers (*Melanerpes formicivorus bairdi*) habitually store, in large quantities, in holes pecked in the pine bark.

ULMUS CRASSIFOLIA Nuttall.

CEDAR ELM.

A tall tree, 15 to 30 meters (50 to 100 feet), along the streams of south central Texas. It was not seen west of Devils River.

CELTIS OCCIDENTALIS Linnæus.

HACKBERRY.

The hackberry is a common tree in southwestern New Mexico and southeastern Arizona. It was first met with, going west at Monument No. 40, about 100 miles west of the Rio Grande, in the Apache Mountains. It was found in the canyons of the Dog Mountains, New Mexico, and on the plain near Alamo Hueco Spring, several remarkably large specimens were observed growing beside a dry arroyo. In descending through Guadalupe Canyon, from the high Animas Valley, the first hackberries were met with at the altitude of 1,481 meters (4,860 feet). A photograph of one was made at 1,493 meters (4,800 feet). It is of frequent occurrence on the upper course of the San Bernardino River. On the western slope of the Sulphur Spring Valley, at the altitude of 1,402 meters (4,600 feet), a superb grove of hackberry trees occupies the bed of a dry watercourse. It is common in ravines of the Mule, Huachuca, and Patagonia mountains, as well as throughout the upper Santa Cruz Valley. None of the largest specimens was measured; but I should roughly estimate their size at about 1 meter (3 feet) in diameter by 15 meters (50 feet) in height. The altitudinal range of this species is from 975 meters, or 3,200 feet (on the San Bernardino River near the mouth of Cajon Bonito Creek), to 1,700 meters, or 5,578 feet (Bisbee, Arizona).

CELTIS RETICULATA Torrey.

PALO BLANCO.

This tree was collected at Monument No. 90, Mexican Boundary Line, south of Bisbee, Arizona. It has been recorded by Dr. N. L. Britton as among the collections sent in by Maj. Timothy E. Wilcox from the Huachuca Mountains, Arizona. As observed by us, it is a small tree in arroyos, below the general timber line. I did not meet with it, to the eastward, beyond the headwaters of the Rio Yaqui.

CELTIS MISSISSIPPIENSIS Bosc.

SUGARBERRY.

A common tree at Fort Clark, Kinney County, Texas; also on the Devils River, Texas.

MORUS RUBRA Linnæus.

RED MULBERRY.

Texas, east of the Devils River. Las Moras Creek, at Fort Clark, in Kinney County, received its name from the former abundance of this tree on its banks. At present it is scarce there, only a few small trees having been observed by us, but we were fortunate in obtaining a specimen.

MORUS CELTIDIFOLIA Humboldt, Bonpland, and Kunth.

MEXICAN MULBERRY.

This mulberry was first seen in the Dog Mountains. There are some fine ones at Dog Spring, which, we were informed, were the only trees around the spring when the ranch was first established.

The species was subsequently found in Guadalupe Canyon; on Cajon Bonito Creek, one of the heads of the Yaqui River; at Niggerhead in the Perrilla Mountains; at the base of the San José Mountains, Sonora; on the San Pedro River and Babocomeri Creek (altitude 1,481 meters, or 4,860 feet), Arizona; on the upper Santa Cruz River; and it also occurs at Forts Whipple and Verde, in central Arizona. Its vertical range is from 1,219 meters (4,000 feet or less) up to about 1,524 meters (5,000 feet).

UMBELLULARIA CALIFORNICA (Hooker and Arnott) Nuttall.

CALIFORNIA LAUREL.

This small but handsome tree was found only at or near the summits of the Coast Range Mountains, in the Transition zone.

LYONOTHAMNUS FLORIBUNDUS ASPLENIFOLIUS (Greene) Brandegee.

SAN CLEMENTE IRONWOOD.

A small tree on San Clemente Island, off the coast of southern California.

PLATANUS OCCIDENTALIS Linnæus.

SYCAMORE.

A very large tree; common on the banks of streams east of the Pecos River, in Texas.

PLATANUS RACEMOSA Nuttall.

CALIFORNIA SYCAMORE.

The range of this sycamore is from the west slope near the summit of the Coast Range Mountains to the Pacific. In the neighborhood of the Boundary Line it is a smaller tree than the Arizona sycamore.

PLATANUS WRIGHTII Watson.

ARIZONA SYCAMORE.

A splendid tree, 1 to 3 meters (3 to 10 feet) in diameter and 15 to 30 meters (50 to 100 feet) in height, growing along streams of the Elevated Central Tract. I first met with it in the Dog Mountains, New Mexico. It was subsequently found along nearly every stream or watercourse to the western extremity of the Pajaritos Mountains of Sonora and Arizona. Its determined vertical range is from 975 meters or 3,200 feet (junction of Cajon Creek with the San Bernardino River, Sonora) to 2,042 meters or 6,700 feet (San José Mountains, Sonora).

VAUQUELINIA CALIFORNICA (Torrey) Sargent.

VAUQUELINIA.

A handsome tree, about 3 to 5 meters (10 to 15 feet) in height. growing sparsely on the otherwise barren hills bordering the Guadalupe Canyon, in the adjacent corners of Arizona, New Mexico, Chihuahua, and Sonora. A tree that was photographed grew at the altitude of 1,402 meters (4,600 feet) in the southeastern corner of Arizona.

CERCOCARPUS PARVIFOLIUS BETULOIDES (Nuttall) Sargent.

BIRCHLEAF MAHOGANY.

A tall shrub or small tree, abundant in the mountains of the Coast Range in California.

CERCOCARPUS PARVIFOLIUS PAUCIDENTATUS Watson.

ENTIRELEAF MAHOGANY.

This is the common mahogany of the mountains of the Elevated Central Tract. It was found at the summit of the Hachita Grande (altitude 2,545 meters, or 8,350 feet) and in canyons of the Dog Mountains (altitude 1,868 meters, or 6,129 feet); is common on the lower slopes, ranging also to the highest summits of the San Luis, Animas, and San José mountains, and is also common on the Huachuca, Patagonia, Pajaritos, and other moutains of southern Arizona, as well as at Bakers Butte, in central Arizona.

ADENOSTOMA SPARSIFOLIUM Torrey.

RED-SHANK CHAMISO.

A very attractive small tree of the west slopes of the Coast Range Mountains, found by us from Jacumba Spring (Monument No. 233) west to Pine Valley, California, and Nachoguero Valley, Lower California, its range being much narrower than that of the common shrubby chamiso (*Adenostoma fasciculatum obtusifolium* S. Watson). The "red-shank" has red branches, reddish shreddy bark, and bears small white flowers copiously in June.

AMELANCHIER ALNIFOLIA Nuttall.

WESTERN SERVICE TREE.

A small tree, at the summit of the Coast Range (Laguna Mountains), California.

HETEROMELES ARBUTIFOLIA (Poiret) Roemer.

TOYON; CHRISTMAS BERRY.

A small tree, ranging from the Santa Barbara Islands up to about 1,372 meters (4,500 feet) altitude on the west slope of the Coast Range Mountains, in California and northern Lower California. The form which we found on San Clemente Island grows to be a larger tree with broader leaves than that of the mainland.

PRUNUS DEMISSA (Nuttall) Walpers.

WESTERN CHOKE CHERRY.

This, a tree of medium size, was found near the summit of the Laguna Mountains of the Coast Range, about 15 miles north of the Mexican Border.

PRUNUS SALICIFOLIA Humboldt, Bonpland, and Kunth.

WILLOWLEAF CHERRY; MEXICAN CHERRY.

The common cherry of the Elevated Central Tract. A small tree 0.34 to 0.64 meter (1 to 2 feet) in diameter and 6 to 10 meters (20 to 35 feet) in height, with white wood and thin-seeded fruit. It was obtained in the San Luis, San José, and Huachuca mountains. Its determined vertical range is from about 1,341 meters, or 4,400 feet (Cajon Bonito Creek, Chihuahua), to 2,198 meters, or 7,210 feet (San José Mountains, Sonora). On the north slope of the San José Mountains a tree measuring 0.34 meter (1 foot) in diameter and about 5 meters (15 feet) in height was found at the altitude of 2,027 meters (6,650 feet); a tree 0.34 by 6 meters (1 by 20 feet) at 2,042 meters (6,700 feet) altitude; a tree 0.64 by 10 meters (2 by 35 feet) at 6,740 feet altitude; several trees at the Upper Spring (2,054 meters or 7,060 feet altitude), the largest measuring about 0.5 by 7.5 meters (1.64 by 25 feet); a tree 0.64 by 7.5 meters (2 by 25 feet) at 2,194 meters (7,200 feet) altitude, and several small trees at 2,197 meters (7,210 feet).

PRUNUS ILICIFOLIA (Nuttall) Walpers.

HOLLYLEAF CHERRY.

This, a small-sized tree, is the common cherry on the summits and Pacific slopes of the Coast Range Mountains, in the neighborhood of the International Boundary Line.

PRUNUS INTEGRIFOLIA (Sudworth) Sargent.

ENTIRELEAF CHERRY.

A tree about 5 to 8 meters (15 to 25 feet) in height, growing in moist canyons on San Clemente Island, California.

ACACIA FARNESIANA (Linnæus) Willdenow.

HUISACHE.

This beautiful and fragrant tree was found on the banks of Las Moras Creek, Kinney County, Texas. It is an abundant species in the region round about San Antonio, Texas.

ACACIA GREGGII Gray.

DEVILS CLAWS.

A common tree of Arizona and southern California; abundant along the Mexican Border. The larger trees have the trunk a foot in diameter and reach the height of 20 feet. At Pozo de Luis these acacias were shedding their leaves in January. It is a species of the Sonoran Zone. In southwestern Texas there is a shrub acacia resembling *Acacia greggii* (Cat. No. 1523, July 1, 1893, Sierra Blanca, Texas), but with smaller leaves.[a]

PROSOPIS ODORATA Torrey and Frèmont.

TORNILLO; SCREW BEAN.

A slender, graceful tree, bearing twisted pods and whitish spines; abundant along streams of the Lower Sonoran zone from the Rio Grande of Texas to the Coast Range Mountains of California. It is usually of the size of the devils claws (*Acacia greggii*), though sometimes rivaling the mesquite. Along the Colorado River, in the vicinity of Fort Mohave, Arizona, the forests of screw beans are utilized by the Mohave Indians, who use the fruit for food. Heaps of screw beans may be seen in all of their settlements.

PROSOPIS GLANDULOSA Torrey.

MESQUITE.

This is a common tree or shrub, as the case may be, from the Gulf coast of Texas to the Pacific Ocean, though it is rare west of the Coast Range Mountains, along the Mexican Boundary Line. The vertical range of the mesquite is from sea level (near Monument No. 258), and below it (in parts of the Colorado Desert) up to the lower timber line (altitude 1,692 meters, or 5,550 feet, near Langs Ranch) on the mountains of the interior. This is an exceedingly variable species. In Texas it grows as a small tree, having a drooping habit, and fern-like, long pinnate leaves. In the deserts of New Mexico, Arizona, and California it becomes a shrub, forming mounds or sand hills in the most fertile places. Along the Colorado River and its tributaries it becomes a tree of considerable size. Along the Santa Cruz River, in Sonora, are forests of unusually large mesquites, some of which measure 2½ feet in diameter and 50 feet in height. The mesquites of the Colorado River bottom, below Fort Mojave, also have distinct trunks and grow to an unusual height.

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[a] Another acacia (*Acacia constricta* Bentham), usually considered as a shrub, becomes a small tree on the headwaters of the Yaqui River, near the International Line and the boundary between New Mexico and Arizona.

On the head of the Yaqui River, in Guadalupe Canyon, and along Cajon Bonito Creek and the San Bernardino River the mesquite has the habit of a tall, much-branched shrub, or frequently a small tree, with a distinct trunk, bearing pods of a peculiar form and leaves with crowded and very small pinnæ. It is probable that at least three forms of the mesquite will eventually be recognized from the Mexican border of the United States as follows:

(1) The mesquite of eastern Texas, west to Devils River, having a slender, drooping habit, with few and long leaflets; fruit not seen. (2) The mesquite of the upper Rio Grande, extending thence west to the Pacific Ocean; differs from the above in habit of growth and in having smaller leaflets.[a] (3) The mesquite of the San Bernardino, Guadalupe, and Cajon Bonito creeks, headwaters of the Yaqui River, having minute leaflets and a different fruit from No. 2.

The mesquite loses its foliage in winter, regaining it in April and May. At Maricopa, March 31, 1885, it was noted as not yet in leaf, and at Deming, New Mexico, April 24, 1885, as just unfolding its leaves.

CERCIS RENIFORMIS Engelmann.

TEXAS REDBUD.

This small tree is very abundant in the vicinity of Fort Clark, Texas, and thence west to Devils River, growing in the neighborhood of streams.

PARKINSONIA ACULEATA Linnæus.

HORSE BEAN.

This graceful tree is extensively cultivated in the border towns. It grows from Texas to California, but was only found in a wild state in the neighborhood of La Osa and La Ventana, in Pima County, Arizona, and sparingly on the Sonoyta River, Sonora, Mexico. It is a tree of the Lower Sonoran zone. The trunk is usually less than 0.34 meter (1 foot) in diameter, the tree seldom exceeding 9 meters (30 feet) in height.

PARKINSONIA MICROPHYLLA Torrey.

SMALLLEAF HORSE BEAN.

A beautiful and abundant tree, on the Mexican Border between the Pozo Verde Mountains and the Colorado River. It is also found about Fort Lowell, and along the Gila, Salt, and Verde rivers, in Arizona. The bark is smooth, waxy, and bright yellowish-green throughout, including the trunk down to the ground. This tree often reaches the height of about 6 meters (20 feet), with the trunk

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[a] Dr. Mearns' No. 1 is *Prosopis glandulosa* Torrey, his No. 2 is *Prosopis velutina* Wooten.—EDITOR.

0.34 meter in diameter. We found it most abundant at Pozo de Luis and in the Sonoyta Valley. Its local distribution differs from that of the Palo Verde (*Cercidium torreyanum*) in that its habitat extends to the hills and rocky places instead of being restricted to the edges of arroyos.

CERCIDIUM TORREYANUM (Watson) Sargent.

PALO VERDE.

This tree resembles the small-leaf horse-bean (*Parkinsonia microphylla*), but is larger, with the bark less yellowish and waxy in appearance; bark mostly smooth, but gray on the large trunks, instead of green throughout. The leaves are larger. The well-known Palo Verde is a tree of the Lower Sonoran Zone, ranging from the Colorado Desert, where it blooms in April, east nearly to the Pozo Verde Mountains, on the Mexican line. On the plain west of the Sierra de la Salada the finest specimens of this beautiful tree were seen. The largest had a trunk nearly a meter (2.5 to 3 feet) in diameter and about 10 meters (33 feet) in height.

SOPHORA SECUNDIFLORA (Cavanilles) de Candolle.

FRIJOLILLO; FRIGOLITO; CORAL BEAN.

A small tree of the Rio Grande Valley, abundant in the vicinity of Fort Clark, Texas, where it is known to the Americans as the laurel and to the Mexicans as the "frijolillo." It bears deep green leaves of about 9 elliptical-oblong coriaceous leaflets and showy terminal racemes of violet (sometimes white) flowers, which are very fragrant; but, like those of *Robinia*, becoming overpowering and nauseating when kept in large amount in a close room. The large woody pods contain 1 to 4 rounded red beans, as large as small marbles, and said to be poisonous. It is abundant in Devils River Valley.

EYSENHARDTIA ORTHOCARPA (Gray) Watson.

EYSENHARDTIA.

A small tree in canyons on the headwaters of the Yaqui River. It grows abundantly about the rock bases of Niggerhead, the Cerro Gallardo, and at San Bernardino Springs.

PAROSELA SPINOSA (Gray) Vail.

INDIGO THORN; MANGLE.

This is a tree 7 to 10 meters (23 to 33 feet) in height and 2 to 4 cm. (7.9 to 15.7 inches) in diameter, spiny and of close habit. Its copious violet-colored flowers yield a delicious fragrance. It was first met with in the Sonoyta Valley, Sonora, Mexico, where, contrary to the habit of other trees of the region, it grew in the sandy bottoms of arroyos instead of upon their banks. It suckers profusely. We also found it in arroyos about Tule Wells, and in canyons at the eastern base of the Coast Range Mountains in California. It is known to Mexicans as the "mangle."

ROBINIA NEOMEXICANA Gray.

NEW MEXICO LOCUST.

This beautiful locust grows in mountain canyons, ranging from western Texas to Arizona. The largest are small trees from 3 to 4 meters (10 to 15 feet) in height, ripening their fruit in August. On the San José Mountains, Sonora, Mexico, its range extends from 1,737 to 2,621 meters (5,700 to 8,600 feet), or from the Sonoran to the upper limit of the Transition zone.

OLNEYA TESOTA Gray.

SONORA IRONWOOD; PALO DE HIERRO.

This important tree of the Sonoran deserts ranges from the Sierra de Moreno (Monument No. 146) to the Sierra de la Salado (Monument No. 175), on the Boundary Line, reappearing on the Colorado Desert to the westward, where it is called "Arbol de Hierro." It is known in Arizona as the "Palo de Hierro" and is a tree 6 meters (20 feet) in height and half a meter (1½ feet) in diameter, with gray, shaggy bark on the trunk and larger limbs, the young shoots being bright green. The wood makes poor fuel and gives rise to a very disagreeable odor when burning. Between the Sierra de la Salada and la Représo, in which region this tree is generally distributed, though largest and most numerous along the arroyos or dry watercourses, the finest examples of the ironwood tree were seen. One of them was three-fourths of a meter (2½ feet) in diameter and 10 meters (33 feet) in height.

PTELEA TRIFOLIATA Linnæus.

HOPTREE.

Several species of *Ptelea* were collected. On San José Mountains, State of Sonora, Mexico, was found *Ptelea sancta* Greene and perhaps *P. betulifolia;* on San Luis Mountains was found *P. jucunda* Greene, a handsome species with chestnut-colored branches, while on Huachuca Mountains *P. cognata* Greene is a common shrub. The leaves of the last exhale a very powerful odor.

HOLACANTHA EMORYI A. Gray.

HOLACANTHA.

This was a large tree, west of San Bernardino River, near Monument No. 79, Mexican Boundary Line.

KŒBERLINIA SPINOSA Zuccarini.

KŒBERLINIA; JUNCO.

An intricate spiny shrub growing in sandy places along the Rio Grande of Texas and west to Tucson, Arizona.

FREMONTODENDRON CALIFORNICUM (Torrey) Coville.

FREMONT TREE; FREMONTIA.

This tree was found in the Jamul Valley, between El Nido and Dulzura, California.

RHUS INTEGRIFOLIA (Nuttall) Bentham and Hooker.

WESTERN SUMACH.

This, the only arborescent species of sumach seen by us on the Mexican Line, was found at Point Loma, San Diego County, California.

ACER SACCHARUM GRANDIDENTATUM (Nuttall) Sudworth.

LARGETOOTH MAPLE.

This is the hard maple of the Mexican Border region. I also saw it in the Mogollon Mountains, of central Arizona, where the leaves turned red in October. Usually it is a small tree in ravines or canyons of the mountains; but in Turkey Canyon, in the San Luis Mountains, near Monument No. 66 of the Mexican Boundary Line, a tree was found which measured 2.25 meters (7.4 feet) in circumference 1 meter above the ground, the trunk continuing about the same size for 6 meters (20 feet), then dividing into three nearly equal branches. This tree was estimated to be about 18 meters (59 feet) in height.[a] Several trees of this species in the neighborhood approach this one in height. It was common at about 1,970 meters (6,000 feet) altitude on the San Luis, San José, and Huachuca mountains.

ACER NEGUNDO Linnæus.

BOXELDER.

The boxelder was found on the San José Mountains, State of Sonora, Mexico, and on the Huachuca Mountains and the Verde River, in Arizona, ranging in altitude from 1,006 meters or 3,300 feet (in the Verde Valley) to 2,085 meters or 6,840 feet (canyon on north side of the San José Mountains).

UNGNADIA SPECIOSA Endlicher.

TEXAS BUCKEYE; MEXICAN BUCKEYE.

This is a very small tree, found in the vicinity of Fort Clark, Kinney County, Texas. The seeds or "beans" are similar to chestnuts, but poisonous.

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[a] A photograph of this tree is reproduced and faces page 15 of the Report of the Boundary Commission, 1898.

SAPINDUS MARGINATUS Willdenow.

WILD CHINA TREE.

The wild china tree was found along Las Moras Creek at Fort Clark and on the San Pedro River in Texas, and thence along the Border Line, in the Sonoran Life Zone, to south-central Arizona, ranging in altitude from 300 to 1,070 meters (about 1,000 to 3,500 feet). It was abundant, forming handsome shady groves in valleys on the headwaters of the Yaqui River and in the Verde Valley of central Arizona.

RHAMNUS CROCEA Nuttall.

EVERGREEN BUCKTHORN.

This tree was found at Campbell's Ranch at Laguna, in the Coast Range Mountains, 32.2 km. (20 miles) north of Campo, and on San Clemente Island. This last specimen but slightly resembles *Rhamnus insularis* Greene.

RHAMNUS PURSHIANA de Candolle.

BEARBERRY; CASCARA BUCKTHORN.

The bearberry was found in the San Luis, San José, and Huachuca mountains, and on the headwaters of the Cajon Bonito Creek near the boundary of Sonora and Chihuahua, Mexico.

ZIZYPHUS OBTUSIFOLIUS Gray.

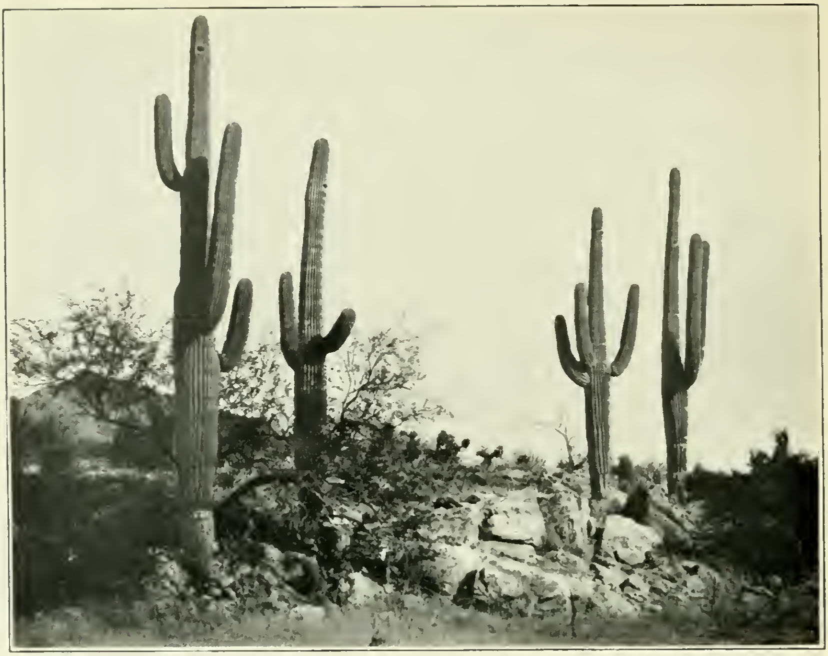
OBTUSELEAF ZIZYPHUS.

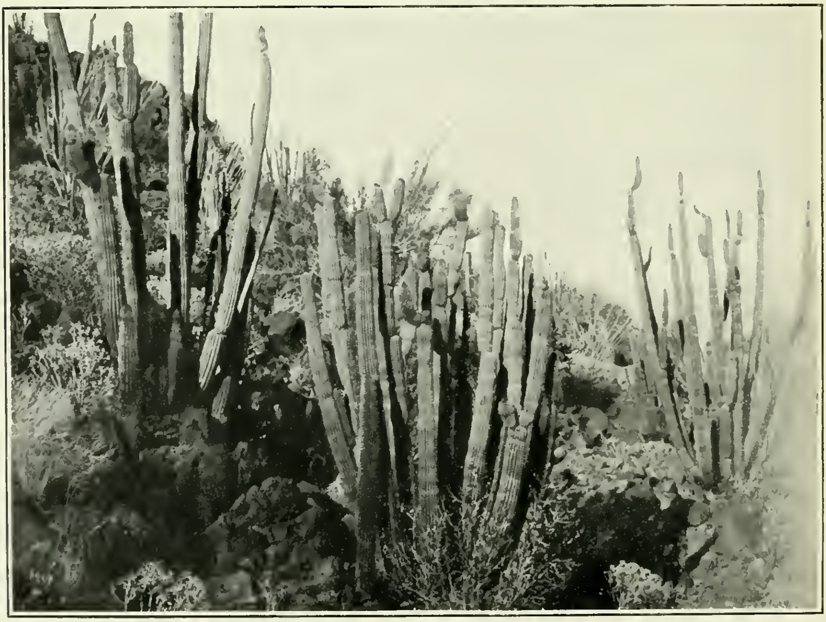
In Arizona and Sonora this species sometimes becomes a small tree having a trunk 1 to 4 decimeters in diameter and a height of 3 to 6 meters. The branches are all armed with very long spines. It usually branches from the ground around main trunks, spreading so as to form an impenetrable growth.

CEREUS GIGANTEUS Engelmann.

GIANT CACTUS.

This, our tallest cactus, bears an edible fruit and attains the height of 12 meters (40 feet). It is known in Arizona and Sonora as the "sahuara." A good picture of it faces page 23 of the Report of the Boundary Commission, published in 1898. As we moved west on the Mexican Line this species first appeared in canyons of the Pajaritos Mountains, west of Nogales, near Monument No. 130. It extended westward to the west base of the Gila Mountains, east of the Colorado River. In the lower course of the Santa Cruz Valley, from Tumacacori northward in Arizona, its range extends farther eastward than on the Boundary Line. It reaches up the Agua Fria Valley of central





1. Cereus giganteus (See Page 65).
2. Cereus thurberi (See Page 66).

Arizona to the head of Black Canyon (between Antelope and Bumble Bee), and up the Verde River to Bloody Basin, between old forts Verde and McDowell. It also occupies southern slopes of hills between San Carlos and Globe City, Arizona. On Tonto Creek its range extends nearly to the Wild Rye. Large sahuaras (40 feet in height) were noted on Ash Creek, a tributary of the Gila, at the foot of Black Canyon, in Graham County, Arizona. The sahuara affords safe nesting places for many species of birds and a secure retreat to several small mammals. It seldom grows upon the desert plains, but appears as soon as the bordering foothills are approached, extending up the slopes and canyons to the upper limit of the Lower Sonoran zone. (Plate VIII, fig. 1.) On April 4, 1885, I passed, near Rillito Station in the Santa Cruz Valley, a ranch owned by an Englishman who had planted *Cereus giganteus* to form a fence, which would have been a great success had not he mistaken some *Echinocactus wislizeni* for the sahuara, the latter having outgrown the bisnagas, leaving gaps in his fence. Respecting the season of flowering, etc., I find the following data in my journal:

May 5, 1885, when marching from Mountain Spring to Fort Lowell, Arizona, I saw circles of opening buds on the summits of the sahuaras for the first time. Four days later, on Picacho Peak, Arizona, the sahuaras were crowned with wreaths of white flowers. At Casa Grande, May 10—

> all of the sahuaras are now in bloom. * * * After turning the point of a mountain between the Gila River and Phoenix, Arizona, we came to a forest of the giant sahuara, which I noted as being of somewhat larger size and more branched than those seen between here and Mountain Spring [near Tucson]. I think one that I saw would measure between 40 and 50 feet in height, but this may be an overestimate. One of its arms or joints would exceed the average size of those growing about Bumble Bee or on New River—the northern and upper limit of its range.

Lieutenant Gaillard writes:

> Probably nowhere along the boundary does the cactus growth attain such luxuriance as in the foothills of the Sonoyta Valley. The giant cactus here attains a height of 40 or 50 feet and forms perfect forests, if the word forest can properly be applied to a collection of these strange, ungainly, helpless-looking objects, which seem at times to stretch out clumsy arms appealingly to the traveler, and which one can not see on its native desert without unconsciously associating it with the uncouth forms of vegetation peculiar to the Carboniferous era.

Maj. John G. Bourke gives the following:

> And the majestic "pitahaya," or candelabrum cactus, whose ruby fruit had long since been raided upon and carried off by flocks of bright-winged humming-birds, than which no fairer or more alert can be seen this side of Brazil. The "pitahaya" attains a great height in the vicinity of Grant, Tucson, and MacDowell [Arizona], and one which we measured by its shadow was not far from 55 to 60 feet above the ground.—On the Border, 2d ed., 1892, pp. 53–54.

CEREUS THURBERI Engelmann.

THURBER CACTUS; PITAHAYA; PITAHAYA DULCE.

On the Boundary Line this huge plant ranges from the Sierra del Cóbota west to the Quitobaquita Mountains (Monuments Nos. 150 to 176). Its range does not extend far into the United States, probably nowhere reaching the Southern Pacific Railroad. It bears an excellent fruit, two crops ripening each year, in July and October. The Papagos live on it exclusively. (Plate VIII, fig. 2.)

CEREUS SCHOTTII Engelmann.

SCHOTT CACTUS; SINITA.

This superb cactus was found only between the Sierra de la Salada (Monument No. 175) and Monument No. 179. On most of this stretch of country it was very abundant.

The range of another giant cactus (*Cereus pringlei*) extends north to within 40 miles of the United States border, south of the Sonoyta Valley.

OPUNTIA FULGIDA Engelmann.

CHOYA.

This arborescent *Cylindropuntia* reaches the height of 3 meters, or 10 feet. It is abundant in southern Arizona.

OPUNTIA VERSICOLOR Engelmann.

TREE CACTUS.

The tree cactus is a striking feature of the scenery of Arizona and Sonora, where it is locally abundant.

OPUNTIA SPINOSIOR (Engelmann) Toumey

SIGURA.

Locally abundant on the Sonora-Arizona boundary.

ARBUTUS ARIZONICA (Gray) Sargent.

ARIZONA MADROÑA.

The madroña is a spreading tree, with reddish-brown rough bark. It was found on the San Luis, Mule San Jose, and Huachuca mountains, occupying a zone extending from near the junction of the upper Sonoran and Transition nearly to the Canadian or lower Boreal. Its ascertained vertical range is from 1,770 meters, or 5,800 feet (Millers Canyon, Huachuca Mountains), to 2,320 meters, or 7,600 feet (San Jose Mountains, Sonora, Mexico). Some remarkably fine examples of this tree were found near a spring in Turkey

Canyon, on the west side of the San Luis Mountains, at an altitude of about 1,970 meters (6,000 feet). The largest was photographed October 2, 1893; three trunks sprang from a common bole, perhaps measuring 9 meters (29 feet) in circumference. The individual trunks measured, respectively, 1 meter above the bole, 3.18 meters (10 feet), 2.51 meters (8.2 feet), and 1.07 meters (3.3 feet) in circumference, and the trees were about 20 meters (65 feet) in height.

Near the Boundary Line, on the west side of the San Luis Mountains, at the altitude of 1,920 meters (6,300 feet), I saw a grove of madroñas composed of unusually large trees. The largest was a double tree having a short trunk measuring 3.5 meters in circumference, the forks measuring, respectively, 2.2 and 1.69 meters in circumference; height estimated at 10 to 12 meters (35 to 40 feet).

ARCTOSTAPHYLOS PUNGENS Humboldt, Bonpland, and Kunth.

MANZANITA.

The manzanita is a gnarled and twisted shrub or low tree, having smooth and shiny reddish-brown bark, and berries which in their season are the favorite food of bears, squirrels, and pigeons. It was found in the Upper Sonoran and Transition Zones of all the high mountains of the Elevated Central Tract from the San Luis to the Pajaritos (Monuments Nos. 64 to 136). In the Canelo Hills, northwest of the Huachuca Mountains, Arizona, was seen an arborescent manzanita 4 meters (15 feet) in height and measuring almost a meter (3 feet) in girth of trunk.

Other species of *Arctostaphylos* were abundant throughout the mountains of the Coast Range in California.

BUMELIA RIGIDA (A. Gray) Small.

SHITTIMWOOD.

This is a spiny shrub or small tree of the Sonoran Life Zone, ranging from western Texas to Arizona. In appearance it is not unlike *Zizyphus*. The largest one seen on the San Bernardino River at Monument No. 77 was about 8 meters (25 feet) in height.

BRAYODENDRON TEXANUM (Scheele) Small. (*Diospyros texana Scheele.*)

MEXICAN PERSIMMON.

The Mexican persimmon was abundant in the region surrounding Fort Clark, in Kinney County, Texas. It flowers in April and May.

FRAXINUS CUSPIDATA Torrey.

FRINGE ASH.

The fringe ash was only found by us on the main Hachita peak of the Big Hatchet Mountains, in Grant County, New Mexico.

FRAXINUS VELUTINA Torrey.

LEATHERLEAF ASH.

This is the common ash of the Mexican Boundary region. Going west we first saw it in damp canyons of the Dog Mountains, and at Alamo Hueco Spring, in Grant County, New Mexico. It was a common tree, west to the Patagonia Mountains, Arizona, occupying damp situations through the Elevated Central Tract, in the Upper Sonoran and Transition Zones. In the Verde Valley of central Arizona it grows as low as 910 meters (3,000 feet), and on San José Mountain, State of Sonora, Mexico, it was found up to 2,290 meters (7,500 feet). Specimens from the Dog Mountains, New Mexico, have much broader leaves than those from more western localities. On the Mexican border this tree reaches the height of 25 meters (80 feet), with the trunk 0.64 meter (2 feet) in diameter. At the Upper Spring, in a canyon on the north side of the San José Mountains (altitude 2,210 meters or 7,250 feet) is a grove of ash trees, seven of which measure from 0.3 to 0.5 meter in diameter and from 15 to 20 meters (50 to 80 feet) in height.

CHILOPSIS LINEARIS (Cavanilles) Sweet.

DESERT WILLOW.

A willow-like tree, about 6 meters (20 feet) in height, bearing terminal racemes of purplish flowers, and seed pods 25 cm. in length. (Plate IX, fig. 1.) It grows in sandy water courses in dry districts from Texas to California, and belongs to the Sonoran Life Zone. I obtained it at Fort Clark, Kinney County, Texas. After leaving the Rio Grande it was not seen until reaching the Upper Corner Monument (No. 40), in Grant County, New Mexico. It was common thence in suitable localities west to Mountain Spring, halfway up the east slope of the Coast Range of California. It is also abundant in central Arizona.

SAMBUCUS MEXICANA de Candolle.

MEXICAN ELDER.

On the east side of the Huachuca Mountains, Arizona, 2,290 meters (7,500 feet) altitude, an elder tree 4.5 meters (15 feet) high, with a trunk measuring nearly a meter (3 feet) in circumference, was found. This specimen (No. 1559, U. S. Nat. Mus.) is marked as having been determined by Dr. N. L. Britton; but I have since seen the ripe fruit, which is *red*. It should be compared with the red-berry elder (*Sambucus callicarpa* Greene). No equally large individuals were seen, but the species was found in several places in the Huachuca Mountains, extending its range up into the pine belt. On the San José Mountain, Sonora, Mexico, it was obtained from 2,200 to 2,225 meters (7,200 to 7,300 feet) altitude.

1. Chilopsis linearis (See Page 68).
2. Rio Grande Opposite the First Monument (See Page 80).

SAMBUCUS GLAUCA Nuttall.

PALE ELDER; SANCO.

On the east, the Mexican sanco was first met with on the Santa Cruz River of Sonora and Arizona, its range extending westward across the Coast Range of California. Specimens were collected in Arizona, California, Lower California, and Sonora, Mexico. Its habitat is along permanent streams and about springs in the Sonoran Life Zone. At Santo Domingo, on the Sonoyta River, Sonora, Mexico, Don Cypriano Ortejo, alcalde of the village, showed me a tree (specimen No. 2718) measuring 1.5 meters (5 feet) in circumference and 8 meters (26 feet) in height, which was known to be 34 years old in the year 1894. This was the largest one seen, although many in the Santa Cruz Valley were large.

INTRODUCED SPECIES OF TREES, NOW GROWING WITHOUT CULTIVATION ON THE MEXICAN BORDER OF THE UNITED STATES.

CHAMAECYPARIS sp.

CEDAR.

An ornamental shade tree which has sparingly escaped from cultivation at Brackettville, Kinney County, Texas.

FICUS sp.

FIG.

Large trees were found growing without cultivation at Strickland Springs, Kinney County, Texas; in the Pozo Verde Mountains, Arizona; in the neighborhood of Sonoyta, Sonora; and at Rancho de San Isidro, Lower California.

MELIA AZEDARACH Linnæus.

CHINA TREE; PRIDE OF INDIA.

A favorite shade tree, introduced from Persia, and now thoroughly naturalized in Texas. The umbrella china-tree (*Melia azedarch umbraculifera* Sargent) grows luxuriantly at Fort Clark, Texas.

SCHINUS MOLLE Linnæus.

PEPPER TREE.

A favorite shade tree in southern California, often growing half wild about deserted ranches.

EUCALYPTUS (several species).

Shade trees at Tucson and La Osa, Arizona, and throughout the coast region of southern California.

NICOTIANA GLAUCA Graham.

CONETON; TRONADORA: TOBACCO.

A South American tree, naturalized and frequently cultivated on the Mexican Border, from Texas to California. "Natives of Buenos Ayres; naturalized in Mexico; formerly cultivated; now wild" (Botany of California).

Several introduced species of palm grow in semicultivation on the Mexican Border, about towns.

LIFE AREAS OF THE MEXICAN BOUNDARY REGION.

The land areas of North America comprise three primary biologic regions: a Boreal Region, an Austral Region, and a Tropical Region, each forming a broad belt that extends transversely across the continent. In general, the Boreal Region corresponds to British America, also including Greenland and Alaska; the Austral Region to the United States; and the Tropical Region to Mexico, the West Indies, and Central America. Owing to the differences of temperature as a controlling factor, the boundaries of these primary regions are, however, very irregular, conforming to certain isothermal lines, rather than to parallels of latitude. Thus, over limited and detached areas in which differences in altitude give similar temperatures, the Boreal belt is pushed south through the whole breadth of the Austral, and extends into Mexico, or portions of the Austral belt are crowded across the Tropical, as in the high table-land of Mexico. It is not strange, therefore, that while the border region of Mexico and the United States lies in greater part within the lowest division of the Austral Region (Lower Austral Life Zone), a line drawn from either end of the Boundary Line to the summit of San Francisco Mountains, in central Arizona, crosses the same primary life areas that are bisected by a line drawn from the equator to the north pole through the continent of North America. The mountain ranges crossed by or in close proximity to the Mexican Boundary Line are not nearly so high as San Francisco Mountains, which is the highest land in Arizona; but we have, nevertheless, portions of each of the three primary biologic regions in the boundary strip, beginning on the east with the Tamaulipan or highest division of the Tropical Region, rising through the three subdivisions of the Austral Region, penetrating the lowest zone (Canadian) of the Boreal in the highest mountains of the interior, and again descending through the Austral to the Lower Californian division of the Tropical Region on the west.

Although the Tropical and Boreal areas of the Mexican Boundary strip are so small as to be geographically insignificant, the fact that each possesses a wholly distinct flora and fauna gives them biological importance out of proportion to their extent. Before proceeding to a discussion of the composition of their faunal and floral elements, it will be well to take up the subject of subdivisions of the primary regions, which may be classified as below:

Primary regions.	*Secondary life zones.*
1. Boreal Region	1. Arctic or Arctic-Alpine Zone. 2. Hudsonian Zone. 3. Canadian Zone.
2. Austral Region	4. Transition Zone. 5. Upper Austral Zone. 6. Lower Austral Zone.
3. Tropical Region	7. Tropical Areas.

The Boreal and Austral regions are each naturally divided into three subsidiary transcontinental zones, their boundaries being irregularly sinuous in conformity to the governing isotherms, just as in the case of the primary regions.[a]

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[a] A knowledge of the life areas, and of the so-called faunas and floras is indispensable to the student of biology whose field has an uneven surface, or occupies a large extent of country. The time spent in mastering the life zones of his field will save the expenditure of a vast amount of speculative energy—in wondering, for instance, why it is that he finds as many forms of a certain group at a certain point on the Pacific slope of the Sierra Nevada of California as are found between those mountains and the Atlantic, the answer to which is that the same life areas fall within each field, one in a belt only 10 miles in width, the other more than 200 times as wide. The Historical Synopsis of Faunal and Floral Divisions Proposed for North America, by Dr. C. Hart Merriam (Proc. Biol. Soc. Wash., VIII, pp. 6 to 20), gives the principal authorities on distribution and life areas in America; while, for working purposes, the following will suffice:

By Dr. J. A. Allen: On the Mammals and Winter Birds of East Florida, with * * * a Sketch of the Bird-Faunæ of Eastern North America. Bull. Mus. Comp. Zoöl., II, No. 3, April, 1871.

The Geographical Distribution of North American Mammals. Bull. Amer. Mus. Nat. Hist., XIV, Art. XIV, December 29, 1892, pp. 199 to 243, with 4 colored maps.

By Dr. C. Hart Merriam: Results of a Biological Survey of the San Francisco Mountain Region and Desert of the Little Colorado, Arizona. North American Fauna. No. 3, September 11, 1890, pp. 136+vii, with numerous colored maps and charts.

The Geographic Distribution of Life in North America, with Special Reference to the Mammalia. Proc. Biol. Soc. Wash., VII, pp. 1 to 64, with colored map.

Laws of Temperature Control of the Geographic Distribution of Terrestrial Animals and Plants. The National Geographic Magazine, VI, December 29, 1894, pp. 229 to 238, with four colored maps.

The Geographic Distribution of Animals and Plants in North America. Yearbook of the U. S. Department of Agriculture for 1894, pp. 203 to 214, with map showing life zones of the United States.

For an early account of the life zones or belts of plant and animal life in the mountainous portion of Arizona between the Gila and Colorado rivers, including San Francisco Mountain, attention is called to the writer's essay[a] on the ornithology of the alpine portions of the area under consideration, based on field work extending from 1884 to 1888, in which 100 species of birds, excluding intruders from the upper Austral Zone, are given as representing the avifauna of the Transition and Boreal zones.

It will be observed, on perusal of the literature relating to life areas, cited above, that, accepting Dr. C. Hart Merriam's latest conclusions, which practically differ from those of Allen and other naturalists only in nomenclature, that we have returned to the teaching of our early physical geographies; that there are but three primary biologic and climatic regions the world around, Tropical, Arctic (or Antarctic), and Austral (or Temperate)—hot, cold, and intermediate—and that these are based entirely on temperature.

Doctor Merriam's latest work, in extending the long-recognized eastern life zones across the continent to the Pacific, is theoretically logical for three reasons: (1) Because these six subdivisions of the Austral and Boreal regions are based on practical work in the East, where they were originally established by the older naturalists—Allen, Verrill, and many others—for convenience of classification of associated groups of animals and plants, and in the West they could be utilized as convenient, even if not natural, subdivisions of the primary regions; (2) because practical field work in the West, largely conducted under the guidance of Doctor Merriam himself, has proved that these zones are just as natural and just as convenient in the West as they are in the East; and (3) that the same zones exist on all sides of the earth and on both sides of the equator, and might as well have been continued at once around the Old World and the New, in which case appropriate names could have been applied to each. While there is nothing new in the theory of "life areas" and "temperature control," their general systematic application to the problems dealing with the natural distribution of plants and animals on the earth, and with their artificial introduction into new areas for the uses of man is a matter of importance. Doctor Merriam has defined with admirable clearness a sufficient number of sections of circumpolar life zones, covering the North American continent, for present use; and it is desirable that his system of nomenclature be generally adopted in dealing with them, on account of its popularity and of the large amount of work already based upon it. The correlation of the life zones of the Old World to those of the New has already been taken up by field naturalists employed by the United States National Museum.

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[a] Auk, VII, January to July, 1890, pp. 45–55 and 251–264.

DIFFERENTIATION TRACTS.[a]

When the collection of mammals from the Mexican Boundary was assembled, it became obvious immediately that all of the forms varied geographically and that certain regions stamped certain peculiarities upon all of the species inhabiting them. Pallid forms came always from the two deserts, and dark forms from the elevated tract which separates them and from the coastal regions bordering the Gulf of Mexico and the Pacific Ocean. Again, the pallid forms from the high Eastern Desert Tract differed from the pallid races of the same species in the low Western Desert Tract, and the darker forms from the Elevated Central Tract differed appreciably from those of the Middle Texan Tract and the Pacific Coast Tract. Besides these five principal tracts, which cover almost the whole extent of the Mexican Boundary, it was found that the elements of differentiation tracts penetrate the line from north or south at several points, and these have been styled Minor Differentiation Tracts, as they are not fairly bisected by the Mexican Boundary Line. The islands off either extremity of the Boundary Line also furnish peculiar mammal forms, and have been called Insular Differentiation Tracts. As a whole, the mammals conform regularly to the characteristics impressed upon them by differences in these tracts. It is certain that no mammal is precisely the same in any two of the five principal tracts, although the degree of variation—which is by no means confined to differences in color, but extends to form, proportion, and size—varies in different groups and species. In many cases species pass through a regular intergradation, on the borderland, in passing from one tract to the next. In this work I have characterized these intergrading forms as subspecies, distinguishing as full species overlapping and separated forms, when the latter are not known to intergrade in regions north or south of the line. In the order of occurrence, from east to west, the tracts are as given below:[b]

Padré Island Tract.
Tamaulipan Subtropical Tract.
Middle Texan Tract.
Eastern Desert Tract.
Elevated Central Tract.
Yaqui Basin Subtropical Tract.
Western Desert Tract.
Californian Subtropical Tract.
Pacific Coast Tract.
Santa Barbara Island Tract.

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[a] See Plate II.

[b] The detailed description of collecting stations (pp. 74 to 142) gives a fair idea of the zoographic features of the several tracts.

Padré Island Tract.—This comprises the low, sandy islands lying off the coasts of Texas and Tamaulipas, on which peculiar (usually pale colored) mammals exist.

Tamaulipan Subtropical Tract.—This corresponds to the Rio Grande embayment, a limited area about the mouth of the Rio Grande, in which there is an intrusion of Mexican forms.

Middle Texan Tract.—This includes the region crossed by the Rio Grande between the Rio Grande embayment and the Eastern Desert.

Eastern Desert Tract.—This comprises a portion of the Rio Grande Valley and a group or chain of ancient lake basins and desert plains extending, as bisected by the Boundary Line, from the Quitman Mountains on the east to the meridian line of the Boundary 100 miles west of El Paso.

Elevated Central Tract.—This lies between the last point (Monument No. 53) and the Sonoyta River Valley (Monument No. 163), west of the Cobota and Nariz mountains. This area is more complex than the other tracts, as it contains the high western rim of the continental divide, with altitudinal zones ranging upward from the Lower Sonoran (in the Yaqui Basin) to the lower edge of the Boreal (on the highest mountains); but nearly all of it lies within the Austral Zone.

Yaqui Basin Subtropical Tract.—Increased intensity of coloration characterizes the mammals from the valleys containing the terminal streams of the great Yaqui River of Mexico, some of which rise on the United States side of the Boundary.

Western Desert Tract.—This begins at the Sonoyta Valley, at Monument No. 163, and extends to the east base of the Coast Range Mountains (Monument No. 227). It is divided by the great Colorado River.

Californian Subtropical Tract.—This is characterized by the intrusion of a few peculiar forms from Mexico, in the Colorado Valley and along the east base of the Coast Range Mountains.

Pacific Coast Tract.—This occupies the strip of land between the Colorado Desert and the Pacific Ocean (Monuments Nos. 227 to 258) on the Boundary, but extending far to the north and south.

Santa Barbara Island Tract.--Characterized by very distinct mammal forms, which have a heavy coloration, the reverse of those found upon the islands of the Gulf of Mexico.

DESCRIPTIONS OF PRINCIPAL COLLECTING STATIONS.[a]

These descriptions are followed by a condensed tabular list of 102 principal collecting stations (p. 143), where the most essential data respecting them may be conveniently referred to. In my itinerary, beginning on page 8, will be found such facts regarding the intervening and surrounding country as seem to be important.

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[a] For location of the collecting stations see Plate I.

STATION No. 1.—Fort Worth, Tarrant County, Texas. Altitude, 193 meters (623 feet). Country rather flat; well wooded with deciduous trees. Birds and shells were collected on the South Fork of Trinity River January 30 and 31, 1892, by Mearns and Holzner.

STATION No. 2.—Fort Clark, Kinney County, Texas. Altitude, 308 meters (1,011 feet). The post is located at the head of Las Moras Creek, a wooded stream encircling it on three sides, and is surrounded by a low, nearly level, grassy, mesquite-wooded country, in which there are a few hills and ridges of limestone. The streams and arroyos are fringed with trees and vines, which not infrequently meet from opposite sides, their branches interlacing above the water. Evergreen oak, elm, and pecan are the principal trees along the streams, and patches of scrub oak, redbud, black persimmon, and other shrubbery cover much of the adjacent strip. Farther away from the streams the country is more open and grassy, often sparsely covered with mesquite, which here has a gracefully drooping habit of growth. The region is thickly settled, and in a few places the soil is cultivated.

This station was occupied by me from November 5, 1892, to June 6, 1893, and from July 3 to July 14, 1893. Collections of mollusks, crustaceans, vertebrates, plants, and rocks were made.

In the autumn of 1897 I was again ordered to Fort Clark for station, and remained there from November 15, 1897, to June 15, 1898, when the occurrence of war with Spain gave me a change of location. During this period malarial sickness prevented field collecting to more than a very limited extent.

Flora of Fort Clark.—In this vicinity, owing to the length of time that I was stationed here, extensive collections were made, as is shown by the following lists:

The most abundant native trees are:

Texas Spanish bayonet, *Yucca treculeana* Carrière.
Pecan (hickory), *Hicoria pecan* (Marshall) Britton.
Willow, *Salix*—several species.
Durand oak, *Quercus breviloba* (Torrey) Sargent.
Texas oak, *Quercus texana* Buckley.
Cedar elm, *Ulmus crassifolia* Nuttall.
Sugarberry, *Celtis mississippiensis* Bosc.
Red mulberry, *Morus rubra* Linnæus.
Sycamore, *Platanus occidentalis* Linnæus.
Huisache, *Acacia farnesiana* (Linnæus) Willdenow.

Prairie mesquite, *Prosopis glandulosa* Torrey.

Texas redbud, *Cercis reniformis* Engelmann.

Coral-bean. Frijolito. "Laurel," *Sophora secundiflora* (Cavanilles) de Candolle.

Texas buckeye, *Ungnadia speciosa* Endlicher.

Wild china, *Sapindus marginatus* Willdenow.

Mexican persimmon, *Brayodendron texanum* (Scheele) Small.

The following half-wild species of trees, introduced from other localities, were common:

Cedar, *Chamæcyparis.*

Fig, *Ficus.*

Umbrella china tree, *Melia azedarach umbraculifera* Sargent.

Desert willow, *Chilopsis linearis* (Cavanilles) Sweet.

Beautiful cæsalpinia, *Poinciana pulcherrima* Linnæus.

The plants which make up the bulk of the chaparral and the thickets along streams are the Texas barberry (*Berberis trifoliata* Moricand), the blackberry (*Rubus* sp.), the green-bark acacia (*Cercidium texanum* Gray), the true acacias (*Acacia amentacea* de Candolle, *A. berlandieri* Bentham, *A. rœmeriana* Schlechtendal), the Texas colubrina (*Colubrina texensis* Gray), several species of sumach (*Rhus trilobata* Nuttall, *R. microphylla* Englemann, etc.), and the button-bush (*Cephalanthus occidentalis* Linnæus), with which are often associated the Texas fog-fruit (*Lippia ligustrina* Britton), blazing star (*Lacinaria*), and horse nettle (*Solanum carolinense* Linnæus). Vines of many kinds make canopies over the smaller streams, and in open spaces the "calabazilla" or wild pumpkin (*Cucurbita fœtidissima* Humboldt, Bonpland, and Kunth) is abundant. Spanish bayonet, soapweed (*Yucca glauca* Nuttall), and spotted agave (*Agave maculosa* Hooker) cover much of the dry plains, in company with shrubs and members of the cactus family, which include, besides an abundance of prickly pears and *Cylindropuntias*, *Cactus stellatus texanus* (Engelmann), *Cereus* (*Echinocereus*) *cæspitosus* Engelmann and Gray, and other species of *Echinocereus* and several species of the hedgehog-cactus (*Echinocactus horizonthalonius*, *E. setispinus*, and *E. hamatocanthus longihamatus*).

The fauna of this station is rich. Crustaceans, fishes, birds, and mammals are abundant. The reptilian fauna is more varied than at any other station occupied by us. Turtles are numerous in species. *Alligator mississippiensis* Daudin has once been taken about 32 km. (20 miles) south of Fort Clark, and the species is said to exist in lagoons of the Rio Grande a short distance to the eastward. Lizards are abundant. Among those collected are the horned toad (*Phrynosoma cornutum*) and *Liolepisma laterale* (Say). The banks, pools, and streams swarm with aquatic reptiles; on land the bead snake

(*Elaps fulvius*) and rattlesnakes (*Crotalus adamanteus atrox*[a]) are abundant; and numerous other species were collected.

The following is a list of the land and fresh-water mollusks collected in the vicinity of Fort Clark, Texas:[b]

1. *Polygyra texasiana* Moricand.
2. *Limax campestris* Binney.
3. *Bulimulus dealbatus* Say.
4. *Bulimulus dealbatus ragsdalei* Pilsbry.
5. *Bulimulus alternatus mariæ* Albers.
6. *Glandina texasiana* Pfeiffer.
7. *Pupa fallax* Say.
8. *Pupa contracta* Say.
9. *Succinea lineata* W. G. Binney.
10. *Succinea avara* Say.
11. *Succinea luteola* Gould.
12. *Helicina orbiculata* Say.
13. *Zonitoides radiatula* Alder.
14. *Limnæa columella* Say.
15. *Limnæa humilis* Say.
16. *Physa osculans* Haldeman.
17. *Planorbis liebmanni* Dunker.
18. *Planorbis tumidus* Pfeiffer.
19. *Planorbis trivolvis* Say.
20. *Planorbis bicarinatus* Say.
21. *Valvata guatemalensis* Morelet.
22. *Amnicola peracuta* Walker.
23. *Amnicola* sp.
24. *Sphærium elevatum* Haldeman.
25. *Sphærium solidulum* Prime.
26. *Pisidium compressum* Prime
27. *Lampsilis anodontoides* Lea.
28. *Lampsilis texasensis* Lea.
29. *Lampsilis texasensis compressus* Simpson.
30. *Lampsilis berlandieri* Lea.
31. *Lampsilis mearnsi* Simpson.
32. *Anodonta imbecillis* Say.
33. *Unio popeii* Lea.
34. *Quadrula undulata* Barnes.
35. *Quadrula couchiana* Lea.

STATION NO. 3.—Fort Hancock, El Paso County, Texas. Altitude, 760 meters (2,500 feet). Post built on bottom land beside the Rio Grande. Lines of cottonwood and willow mark the shifting courses of the river, which dries up at certain seasons. The river flats are occupied by dense patches of arrowwood, flanked by the tornillo or screwbean and mesquite. Still farther back is an arid waste of sandhills and desert country, forming one of the lower basins of the Eastern Desert Tract, with the characteristic desert flora in which the *Kœberlinia* and a coarse *Senecio* are conspicuous.

This region is sparsely inhabited, not irrigated, nor under cultivation.

This important station was occupied by me from June 7 to July 2, 1893. Large collections of animals and plants were made. The birds and mammals were of special interest, particularly the former, as they were almost all breeding specimens, frequently taken with their nests and eggs, and all typical of the Eastern Desert.

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[a] For convenience the determinations and nomenclature of Edward D. Cope in the work entitled The Crocodilians, Lizards, and Snakes of North America, printed in the Report of the U. S. National Museum for 1898, are here adopted.

[b] The greater part of these were collected after the publication of Dr. William Healey Dall's report on the mollusks collected by the Biological Section of the International Boundary Commission, printed in the Proceedings of the United States National Museum, XIX, 1896. I am indebted to Doctor Dall and Mr. Charles Torrey Simpson for assistance in determining these species.

Record of temperature (Fahrenheit) and sunshine at Fort Hancock, Texas.

1893.	Temperature.		Sunshine.	1893.	Temperature.		Sunshine.
	Highest.	Lowest.			Highest.	Lowest.	
			Per cent.				*Per cent.*
June 1	93	50	43	June 18	101	59	42
June 2	93	44	49	June 19	105	55	50
June 3	98	47	51	June 20	102	50	52
June 4	100	51	100	June 21	104	52	52
June 5	99	56	100	June 22	109	60	49
June 6	101	59	100	June 23	109	64	45
June 7	98	59	100	June 24	108	58	50
June 8	101	52	100	June 25	105	59	46
June 9	106	49	100	June 26	107	58	49
June 10	106	50	100	June 27	108	60	48
June 11	103	64	39	June 28	110	62	48
June 12	105	64	41	June 29	110	70	40
June 13	100	62	38	June 30	107	61	46
June 14	97	49	48	Average for June, 1893	102.9	56.6	46.3
June 15	95	51	44				
June 16	103	58	45				
June 17	103	60	43				

Maximum temperatures.

Month.	1889.	1890.	1891.	1892.	1893.
January	61.48	58.74	56.34	60.22	62.12
February	70.89	71.21	65.25	68.68	65.32
March	70.36	77.70	68.13	73.12	72.19
April	85.40	85.50	80.33	81.33	85.10
May	92.32	95.45	86.43	90.12	88.09
June	97.76	98.76	97.16	102.03	102.86
July	101.48	100.96	102.06	101.03	....
August	97.19	96.71	99.70	95.90	....
September	83.26	91.33	86.76	95.10	....
October	81.93	80.00	83.22	80.45	....
November	63.96	69.57	72.70	68.33	....
December	68.06	64.09	60.19	58.22	....
Average	81.17	82.50	79.85	81.21	79.28

Minimum temperatures.

January	21.41	26.16	14.61	19.35	16.35
February	23.85	23.68	25.36	26.86	38.17
March	34.10	32.67	31.90	33.00	29.06
April	43.80	41.10	38.43	35.33	35.96
May	48.19	50.74	49.68	45.29	46.58
June	56.80	59.43	55.53	51.56	56.56
July	63.77	63.67	64.38	62.50	....
August	60.55	61.39	59.33	56.80	....
September	47.80	53.66	57.06	46.03	....
October	39.48	34.60	37.09	39.16	....
November	22.10	28.56	27.40	27.28	....
December	27.96	25.58	15.19	18.25	....
Average	40.81	41.77	39.66	38.45	37.13

Record of temperature (Fahrenheit) and sunshine at Fort Hancock, Texas—Continued.

Mean temperatures.

Month.	1889.	1890.	1891.	1892.	1893.
January	41.48	42.45	35.47	39.78	39.23
February	47.37	47.44	45.30	47.77	51.74
March	52.26	55.18	50.01	53.06	50.62
April	64.60	63.30	59.38	58.33	60.53
May	70.25	73.09	68.05	67.70	67.33
June	77.28	79.09	76.34	76.79	79.71
July	82.62	82.31	83.22	81.90	-------
August	78.87	79.05	79.50	76.35	-------
September	65.53	72.49	71.91	70.56	-------
October	60.70	57.30	60.64	59.80	-------
November	43.03	49.06	50.05	47.80	-------
December	48.01	44.83	37.69	38.23	-------
Average	61.00	62.13	59.79	59.83	58.19

Annual rainfall: 1889, 6.00; 1890, 4.36; 1891, 3.71; 1892, 6.94; 1893, 5.34.
Average, 5.25; maximum, 6.94; minimum, 3.71.

STATION No. 4.—Belen station, Southern Pacific Railroad, El Paso County, Texas. Altitude, about 1,100 meters (3,610 feet). This region was visited by me in June, 1893. It is largely irrigated and under cultivation. Reptiles, birds, mammals, and plants were collected.

Vegetation.—The Rio Grande and the irrigation acequias are lined with the almondleaf willow, Fremont cottonwood, arrowwood, and *Baccharis;* the rich bottom land, where uncultivated, supports a luxuriant growth of mesquite and tornillo, or screw bean; and green orchards, gardens, and fields of grain and alfalfa are situated between the river and the canal, beyond which lies the desert, with its contrasting flora of scant cactus, *Kœberlinia*, and creosote bush.

STATION No. 5.—El Paso, Texas. Altitude 1,135 meters (3,724 feet); latitude, 31° 45′; longitude, 106° 29′. The Franklin and Muleros mountains close in upon the Rio Grande several miles above El Paso, that town occupying the upper portion of a desert lake basin, which extends down the river to the Quitman Mountains, where it again enters a canyon. This basin is sandy, arid, and sterile, except on the river flats, which are alluvial and very productive where irrigation has been effected.

I was quartered in El Paso while the surveying party was being organized and remained there from February 1 to March 14, 1892. Daily trips were made to the surrounding country, and mammal trapping and bird collecting were systematically carried on. Sometimes these excursions were extended to Juarez, on the Mexican side of the Rio Grande, or down to the cultivated lands about Isletta, on the Texas side of the river; and, after February 17, on which date

Mr. Holzner moved to the first camp of the surveying party, located on the left bank of the Rio Grande opposite to the initial monument of the survey. Daily visits were made to that camp. (Plate IX, fig. 2.) Also visited El Paso in November, 1892, and in June, 1893.

Flora of El Paso.—Valuable collections of plant life were made here.

As usual, the river is bordered by a line of cottonwoods and willows, with arrowwood, *Baccharis*, screw bean, and mesquite covering the adjacent land. (Plate VI, fig. 2.) The higher sandy country supports the usual scant growth characteristic of Sonoran deserts, including the creosote bush, *Ephedra*, *Kœberlinia*, and a long list of cacti. The Texas matrimony vine (*Lycium torreyi* Gray) is a pretty feature of the old, but now abandoned, army post of Fort Bliss. The neighboring Franklin Mountains (altitude 2,175 meters, or 7,136 feet), though rocky, bare, and uninviting, have a more varied flora, of which cacti, aloe, *Dasylirion*, yucca, and sumach are among the most conspicuous components. About the summits of the highest peaks, where there was enough soil, were found the serrate-leaved *Dasylirion*, a low yucca, *Rhus virens* Lindheimer, an *Ephedra*, several species of cactus, four or five species of fern, and a liverwort. On the sides and around the base of the mountains, in addition to the above, we found the following:

Selaginella rupestris (Linnæus) Spring.
Nolina lindheimeriana (Scheele) Watson.
Agave lechuguilla Torrey.
Quercus undulata Torrey.
Fallugia paradoxa (G. Don) Endlicher.
Acacia rœmeriana Schlechtendal.
Fouquieria splendens Englemann.
Kœberlinia spinosa Zuccarini.
Cactus micromeris (Engelmann) Kuntze.
C. stellatus texanus (Engelmann) Coulter.
C. dasyacanthus (Engelmann) Kuntze.
C. tuberculosus (Engelmann) Kuntze.
Echinocactus horizonthalonius Lemaire.
E. wislizeni Engelmann.
Cereus fendleri Engelmann.
Opuntia (*Platopuntia*) *lindheimeri* Engelmann.
O. macrocentra Engelmann.
O. phæacantha Engelmann.
O. tenuispina Engelmann.
O. filipendula Engelmann.
Opuntia (*Cylindropuntia*) *arborescens* Engelmann.
O. grahami Engelmann.
O. leptocaulis de Candolle.
Garrya wrightii Torrey.
Lippia wrightii Gray.
Ibervillea lindheimeri (Cogniaux) Greene.

Animal life.—This station has a rather varied fauna, and its location in the midst of the Eastern Desert Tract gives it an importance which is increased by the fact that much biological material was gathered and sent to Washington by army officers stationed at old Fort Bliss in earlier years, furnishing the types of many described species. Fresh-water mollusks are numerous in the Rio Grande, and land pulmonates occur in the mountains. Owing to the lowness of the water in this portion of the Rio Grande at certain seasons, the fish fauna is limited and variable; but we obtained several species. Birds and mammals are fairly well represented, but, as the species will be fully listed in the special reports on those classes, details are omitted here. A number of turtles were found in the Rio Grande at El Paso, and Prof. J. D. Bruner obtained the ornate box-turtle, *Terrapene ornata* (Agassiz). Lizards and snakes were quiescent during the winter season of our stay; but the efforts of Mr. J. H. Clark, of the old Boundary Survey, and those of Col. J. D. Graham, Maj. W. H. Emory, Lieutenant Ives, Dr. S. W. Woodhouse, and S. W. Crawford, of the Army, have added the following species to the collections of the U. S. National Museum from this station:

Lizards.

Crotaphytus collaris (Say).
Holbrookia texana (Troschel).
Sceloporus clarkii Baird and Girard.
Sceloporus spinosus Wiegmann.
Sceloporus undulatus consobrinus (Baird and Girard).
Sceloporus thayerii Baird and Girard.
Phrynosoma cornutum (Harlan).
Anota modesta (Girard).
Cnemidophorus tessellatus (Say).
Cnemidophorus gularis Baird and Girard.
Eumeces obsoletus (Baird and Girard).
[*Anniella texana* Boulenger. "A single specimen from El Paso, Tex."]

Snakes.

Cyclophis æstivus (Linnaeus).
Coluber emoryi (Baird and Girard).
Rhinochilus lecontei Baird and Girard.
Eutænia sirtalis parietalis (Say).

Batrachians.

Amblystoma tigrinum (Green).
Amblystoma tigrinum californiense Gray.
Bufo compactilis Wiegmann.

Station No. 6.—Rio Grande, Chihuahua, Mexico, opposite old Fort Bliss, Texas. Altitude, 1,130 meters (3,708 feet). Birds and mammals collected by Mearns and Holzner, March 14 and 15, 1892.

Station No. 7.—Monument No. 15, near B. F. Wragg's ranch, 80 km. (49.6 miles) west of the initial Monument on the Rio Grande. Latitude, 31° 47′. Altitude, 1,280 meters (4,200 feet). This camp was occupied from March 20 to April 7, 1892. The lowest point in the neighborhood (distant 3½ miles) is 80 meters lower than the camp. The Florida Mountains, 42 km. (26 miles) northwest of Monument No. 15, have an altitude of 2,249 meters (7,379 feet), and are said to be wooded with red juniper and piñon pine, and to contain good water. They were not visited by any of our party. The nearest water that is available to wild animals is that of the Palomas Lakes, in the Mimbres Valley, 14 miles to the westward. The country is mostly low, rolling, with sand hills and a few volcanic buttes (Aguila Mountains) and low ranges, known as the Seca and Potrillo mountains (altitude 1,280 to 1,800 meters), within a few miles of the camp; these support a growth of bushes and some grass. There are no trees; but yuccas of arborescent habit (*Yucca constricta*

Buckley) occupy areas in the direction of the Palomas Lakes. Ephedras are the most abundant shrubs.

The Seca and Aguila mountains, though barren, are rich in coloring and singular in form. Two elevations, about 3 kilometers (2 miles) southwest of Monument No. 15, were capped by nipple-like buttes of red hornblende-mica-andesite. Below the summits were narrow, horizontal, blackish strata of the same rock, the red variety again appearing below and forming the bulk of the rocky peaks, which rest on a massive base of glassy rhyolite containing opal and an abundance of andesite. A lower ridge a little east of south from the monument and about 1.6 kilometers (1 mile) distant from it is capped with a black, impure obsidian in large irregular masses. Underlying the obsidian is a liver-colored, fine-grained, homogeneous rhyolite in contact with a red, glassy form of the same in a broad stratum under it. Below these is a slate-colored rhyolite, in the form of plates, which ring like metal. Still farther north, nearly on the mesa level, is an extensive cropping of quite pure vitreous obsidian. Between the two localities above described is an enormous dike of hornblende-mica-andesite, varying in color from steel gray to reddish brown. Near and to the south of it is a peak formed by a most hetrogeneous mixture of volcanic rocks on an enormous scale and of extremely coarse structure. The cavities in the amygdaloid rock of this region discharge chalcedony, rock crystal, agate, etc., which lie thickly scattered on the slopes at the bases of some of the cliffs. Neighboring areas are covered with basaltic lava or fragments of black obsidian and blackish rhyolite. Geologic conditions were here found to have produced a distinct effect upon the local distribution and coloration of animals. The sandy soil varies in color from grayish white to yellow and red, and this variation is correlated with similar variations in the coloring of the reptiles and mammals of the region. The snakes, horned toads, and other lizards evinced a decided susceptibility to the influence of the color tints of their surroundings in the localities above described, and it was possible to distinguish the rabbits living in beds of chalcedony mixed with whitish sand from those inhabiting the dark lava flows and beds of obsidian chips.

Station No. 8.—Palomas Lakes, Mimbres Valley, Chihuahua, Mexico. One mile south of Monument No. 21. Altitude, 1,210 meters (3,970 feet). The Palomas Lakes occupy the lower portion of the Mimbres Valley, forming a chain that ends in Lake Guzman, the lowest part of the basin, in Chihuahua, Mexico. Lake Guzman is also fed by the Corralitos River, which enters it from the south, as well as by other smaller streams. Collections, especially of fishes, were made in Lake Guzman by the naturalists of the old survey;

but the locality was not visited by any of our party, though many of the species were collected by us in the Mimbres River (a mere creek), and in the upper Palomas Lakes. The upper lakes swarmed with water birds, of which many were collected from April 7 to 15, 1892. Mammals and reptiles were also abundant. We found but few plants that were fit for the press at so early and dry a season as that of our visit, but Hospital Steward Wagner, who accompanied the party that erected Monuments Nos. 1 to 40 on this section of the Boundary Line, was more successful, as the Monument-Building Party passed through the region after the rainy season. A few Fremont cottonwoods, black willows, kœberlinias, coarse epherdas, cacti, and desert yuccas were the plants most in evidence. Between Monument No. 15 and Lake Palomas there is an extensive grove of desert yuccas (*Yucca constricta* Buckley).

Station No. 9.—Monument No. 23, near Columbus, New Mexico, and 106 kilometers (66 miles) west of the Rio Grande. Altitude, 1,211 meters (3,973 feet). The region is barren and strewn with scoria, with several small mountains around it, the highest being the Tres Hermanas (altitude, 1,742 meters), 10 miles to the northwest.

This dry camp was located a short distance south of the Boundary, and occupied from April 7 to 15, 1892, during which time collections were made in the immediate vicinity, though daily visits were made by either Mr. Holzner or myself to the neighboring Palomas Lakes, where most of the collecting was done, and where Mr. Holzner camped for two days.

Station No. 10.—Carrizalillo Springs, New Mexico. Altitude, 1,381 meters (4,531 feet). There are several large springs, in which there were a few wild fowl and around which aquatic plants and a few planted willows and cottonwoods grew. The nearest Monument (No. 33) is 137 kilometers (85 miles) west of the Rio Grande, on the parallel 31° 47′. The neighboring Carrizalillo Mountains rise to the height of 2,295 meters (7,530 feet), and their summits are sparsely covered with red juniper and smaller vegetation. At this camp the first important collection of plants was made, little having been found at the previous stations. A few land shells and many mammals and birds were collected from April 15 to 22, 1892. Later in the season Hospital Steward Frank Wagner, accompanying the Monument-Building party under Colonel Barlow, also collected plants at this place. The Carrizalillo Mountains are of recent volcanic formation. The highest peak is of bright red rhyolite. The base of this main peak is also of the holocrystalline variety of rhyolite, of a purplish or heliotrope color. Other high peaks of these mountains, on the Mexican side, are highly colored amygdaloidal types of rhyolite. Their ruggedness and beautiful coloring give them considerable beauty.

The following is a list of the arborescent flora:

Juniperus monosperma (Engelmann) Sargent.
Yucca constricta Buckley.
Salix nigra Marshall.
Populus angustifolia James.
Populus fremontii Watson.
Quercus undulata Torrey.
Kœberlinia spinosa Zuccarini.
Sapindus marginatus Willdenow.

The mistletoe (*Phoradendron bolleanum* Eichler) grows abundantly on the one-seed juniper. Other conspicuous plants are the following:

Ephedra trifurca Torrey.
Phragmites phragmites (Linnaeus) Karsten.
Yucca baccata Torrey.
Yucca glauca Nuttall.
Dasylirion sp.
Agave palmeri Engelmann.
Berberis trifoliolata Moricand.
Astragalus nuttallianus trichocarpus Torrey and Gray.
Parosela formosa (Torrey) Vail.
Parosela pogonathera (Gray) Vail.
Fouquieria splendens Engelmann.
Thamnosma texana Torrey.
Rhus microphylla Engelmann.
Opuntia arborescens Engelmann.
Cereus rœmeri Muhlenpfort.
Cucurbita fœtidissima Humboldt, Bonpland, and Kunth.
Senecio filifolius Nuttall.
Perezia nana Gray.

Station No. 11.—Upper Corner Monument (No. 40) at the west end of the boundary parallel 31° 47′. At this point, 159 kilometers (99 miles) west of the Rio Grande, the Boundary Line bends at a right angle and extends south 49.83 kilometers (30.96 miles) on the meridian 108° 12′ 30″. Our camp was made beside Monument No. 40, in the midst of a tangle of hills known as the Apache Mountains, the highest of which has an altitude of 1,656 meters (5,433 feet). The only trees were a few red junipers. Vegetation was, however, more luxuriant than in the region to the eastward. The lowest valley, 4 miles (6 kilometers) west of Monument No. 40, has an altitude of 1,350 meters (4,430 feet); like others of the vicinity, it is covered with good grass. Our animals were kept at Mosquito Springs, our men being supplied with water in metal water wagons from wells at a distance. Collections in nearly all of the departments usually covered were made at this place from April 22 to May 15, 1892. The rock formation in the neighborhood of Monument No. 40, in the Apache Mountains, is largely calcareous. Rising immediately north of the Corner Monument is a series of rounded hills of lime rock, in which the network of (mostly projecting) white veins of silicious materials are very characteristic. In places most of the rocks are covered with nodular projections, from differential weathering, which make walking over them very wearing on shoe leather. There has been an overflowing of lava, and fragments of vitreous obsidian are scattered freely about the region. Southwest from Monument No. 40 lie the Sierra Rica of Chihuahua, the base of which is largely formed of gray and brown hornblende-mica-andesite, infiltrated with quartz and calcite.

The flora is as follows:

Juniperus monosperma (Engelmann) Sargent.
Quercus toumeyi Sargent.
Quercus dumosa Nuttall.
Celtis occidentalis Linnæus.
Morus celtidifolia Humboldt, Bonpland, and Kunth.
Prosopis glandulosa Torrey.
Kœberlinia spinosa Zuccarini.
Sapindus marginatus Willdenow.
Chilopsis linearis (Cavanilles) Sweet.

The most abundant shrubs and conspicuous plants are the following:

Yucca baccata Torrey.
Yucca glauca Nuttall.
Nolina texana Watson.
Nolina lindheimeriana (Scheele) Watson.
Dasylirion texanum Scheele.
Agave palmeri Engelmann.
Fallugia paradoxa (D. Don) Endlicher.
Krameria secundiflora de Candolle.
Fouquieria splendens Engelmann.
Covillea tridentata (de Candolle) Vail.
Ptelea baldwinii Torrey and Gray.
Rhus microphylla Engelmann.
Mortonia scabrella Gray.
Cereus fendleri Engelmann.
Opuntia lindheimeri Engelmann.
Opuntia leptocaulis de Candolle.
Opuntia arborescens Engelmann.
Cucurbita fœtidissima Humboldt, Bonpland, and Kunth.
Baccharis pteronoides de Candolle.
Perezia nana Gray.

STATION No. 12.—Big Hatchet Mountain, Grant County, New Mexico. The main peak lies 18.5 kilometers (11.5 miles) west of Monument No. 44, and has an altitude of 2,545 meters (8,350 feet). The lowest portion of the plain to the eastward, distant about 22 kilometers (13.5 miles, has an altitude of but 1,250 meters (4,101 feet). The zone of piñon pine occupies the upper half of these mountains. At the base are a few red junipers, and at the summit a goodly number of checkerbark junipers. *Agave applanata parryi* is found in abundance at the summit, and *A. palmeri* ("mescal") at the base. A small spring is said to exist in the Hachita Grande, but it was not discovered. In company with Lieut. Francis G. Irwin, Second Cavalry, I established a camp for Mr. Hozlner in the piñon zone, near the main summit of the Hachita Range, May 18 and 19, 1892, visiting the summit and collecting reptiles, birds, land shells, and plants. Mr. Holzner remained until May 25, and collected mammals and birds.

The principal trees are:

Pinus cembroides Zuccarini.
Juniperus monosperma (Engelmann) Sargent.
Juniperus pachyphlœa Torrey.
Quercus undulata Torrey.
Celtis occidentalis Linnæus.
Cercocarpus parvifolius paucidentatus Watson.
Fraxinus cuspidata Torrey.
Chilopsis linearis (Cavanilles) Sweet.

Other plants collected are:

Selaginella rupestris (Linnæus) Spring.
Usnea barbata (Linnæus) Fries.
Nolina texana Watson.
Nolina lindheimeriana (Scheele) Watson.
Dasylirion sp.
Eriogonum cæspitosum Nuttall.
Fendlera rupicola Engelmann and Gray.
Fouquieria splendens Engelmann.
Petela baldwinii Torrey and Gray.
Cactus dasyacanthus Engelmann.
Cereus rœmeri Muhlenpfort.
Opuntia (*Platopuntia* and *Cylindropuntia*, several species of each).
Garrya wrightii Torrey.
Anisacanthus thurberi Gray.

Station No. 13.—Mosquito Springs, Chihuahua, Mexico. These large springs, called "Ojos de los Mosquitos" by the Mexicans, and commonly known as "Mesquite Springs" to the Americans, are situated 2 kilometers (1.25 miles) east of Monument No. 46, at an altitude of 1,270 meters (4,170 feet), in a broad valley between the Boca Grande and Hachita mountains. They mark the western border of the Eastern Desert Tract. The lowest part of the valley is a smooth alkali flat, but the edges are covered with grass, mesquite, and shrubbery. As water is abundant, mammals and birds are plentiful in the neighborhood of the springs. Mr. Holzner occupied this station from May 10 to 18, 1892; the writer, May 15 to 18, and 19 to 21, 1892.

The trees in the neighborhood are the desert yucca, devils claws, mesquite, *Kœberlinia*, and desert willow. Cacti are abundant. Among those seen were arborescent opuntias, prickly pears (*Opuntia lindheimeri* Engelmann, *O. filipendula* Engelmann, and others). At the spring grew the aquatic *Anemopsis californica* (Nuttall) Hooker and Arnott; the neighboring plains were covered, in places, with the tapioca (*Jatropha macrorrhiza* Bentham), and toward the foothills, in which the "ocotillo," mimosas, acacia, and low yuccas were abundant, were broad slopes occupied exclusively by the creosote bush (*Covillea tridentata*). Many flowering plants gave attractiveness to the scenery.

Station No. 14.—Lower Corner Monument (No. 53), at the east end of the boundary parallel 31° 20′, and the south end of meridian 108° 12′ 30″. (See Map, frontispiece.) Altitude, 1,408 meters (4,620 feet). Distance from the Rio Grande, measured on the Boundary Line, 209 kilometers (130 miles). No camp was made here, but the locality was frequently visited from a neighboring camp at Dog Spring. The locality is of interest because of its proximity to Espia, on the Corralitos River, Chihuahua, where the naturalists of the old Mexican Boundary Survey, under Major Emory, made valuable collections in zoology and botany. The most abundant plants are the *Dasylirion*, *Nolina*, and cat's claws (*Mimosa biuncifera* Bentham and *M. lindheimeri* Gray). Here we first saw the rainbow cactus

(*Cereus pectinatus rigidissimus* Engelmann), the range of which extends west to the Pajaritos Mountains.

STATION No. 15.—Dog Spring, Grant County, New Mexico. This splendid spring is about 2 kilometers (1¼ miles) north of Monument No. 55, and has an altitude of 1,475 meters (4,839 feet). It is near the south extremity of the Dog Mountains, a rugged range of which Emory Peak, having an altitude of 1,868 meters (6,129 feet), is the highest. The drainage is toward the Corralitos River, the lowest point surveyed, 6.4 kilometers (4 miles) southeast of Dog Spring, having an altitude of 1,350 meters (4,430 feet). The increase of arboreal vegetation became apparent as we approached this camp from the eastward. The oak, sycamore, walnut, and mulberry were here first met with. Checkerbark juniper crowned the summits of the Dog Mountains, and descended to the foot in a few of the narrow canyons. I camped at Dog Spring from May 21 to 30 and June 3 to 13, 1892, and from September 15 to 23, 1893; Mr. Holzner from May 25 to June 13, 1892. The arroyo extending from Dog Spring to the Corralitos River marks the western extension of several mammals of the Eastern Desert. Extensive collections were made at this camp and in the adjacent Dog Mountains. Leaving the bottom of the valley at our camp and proceeding toward Emory Peak, the ground was everywhere strewn with fragments of chalcedony, many of which had been pasted as ornaments in the cement walls of ancient cliff dwellings by the aboriginal builders. The mountains are largely of rhyolite and hornblende-mica-andesite, the rock being often strikingly colored.

Flora of Dog Mountains.[a]—Here large collections were made and the following lists show the principal varieties of plant life found:

The trees are:

Pinus cembroides Zuccarini.
Juniperus monosperma (Engelmann) Sargent.
Juniperus pachyphlœa Torrey.
Juglans rupestris Engelmann.
Yucca constricta Buckley.
Salix nigra Marshall.
Salix occidentalis longipes (Andersson) Bebb.
Populus fremontii Watson.
Populus angustifolia James.
Quercus oblongifolia Torrey.
Quercus arizonica Sargent.
Quercus emoryi Torrey.
Celtis occidentalis Linnæus.
Morus celtidifolia Humboldt, Bonpland, and Kunth.
Platanus wrightii Watson.
Cercocarpus parvifolius paucidentatus Watson.
Prosopis glandulosa Torrey.
Kœberlinia spinosa Zuccarini.
Sapindus marginatus Willdenow.
Arbutus arizonica (Gray) Sargent.
Bumelia rigida (Gray) Small.
Fraxinus velutina Torrey.
Chilopsis linearis (Cavanilles) Sweet.

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[a] These mountains are sparsely wooded and of the roughest description. On the east side they are furrowed by canyons with jagged, precipitous sides abounding in caves and erosions. The average height of the higher peaks is nearly 1,829 meters (6,000 feet).

Other striking plants of the Dog Mountains are:

Selaginella rupestris (Linnaeus) Spring.
Yucca baccata Torrey.
Dasylirion sp.
Agave palmeri Engelmann.
Nolina lindheimeriana (Scheele) Watson.
Anemopsis californica Hooker and Arnott.
Argemone mexicana Linnaeus.
Fallugia paradoxa (D. Don) Endlicher.
Mimosa biuncifera Bentham.
Acacia filiculoides (Cavanilles) Trelease.
Acacia constricta Bentham.
Cassia wislizeni Gray.
Astragalus mollissimus Torrey.
Astragalus nuttallianus de Candolle.
Krameria secundiflora de Candolle.
Fouquieria splendens Engelmann.
Covillea tridentata (de Candolle) Vail.
Jatropha macrorhiza Bentham.
Rhus trilobata Nuttall.
Rhus microphylla Engelmann.
Zizyphus sp.
Vitis arizonica Engelmann.
Cereus pectinatus rigidissimus Engelmann.
Opuntia lindheimeri Engelmann.
Opuntia filipendula Engelmann.
Opuntia arborescens Engelmann.
Lycium pallidum Miers.
Anisacanthus thurberi Gray.
Cucurbita fœtidissima Humboldt, Bonpland, and Knuth.
Iberrillea lindheimeri (Cogniaux) Greene.
Baccharis pteronioides de Candolle.
Baccharis glutinosa Persoon.
Crassina grandiflora (Nuttall) Kuntze.
Perezia nana Gray.
Trixis angustifolia de Candolle.

STATION No. 16.—Whitewater, Chihuahua, Mexico. This camp was located on the south side of an arroyo, in which a shallow well supplied us with very bad water, about a mile south of Monument No. 61 and 246 kilometers (153 miles) from the Rio Grande, at an altitude of 1,528 meters (5,013 feet), in the midst of the Whitewater Hills, between the East and West Playas. In September, 1893, the Whitewater arroyo contained water. Animal and plant life were abundant, and large collections were made. I occupied this station May 30 and 31, June 2 and 3, June 13 to 22 and 27 to 29, 1892; September 10 to 15 and 23, 1893. Mr. Holzner was there June 13 to 22 and 27 to 29, 1892.

Vegetation.—There were no forests in the immediate vicinity of the station, the only trees being small mesquites and a few straggling oaks, hackberry, mulberry, and wild china trees, together with the desert yucca. On the neighboring East Playas and West Playas valleys were extensive tracts occupied by mimosa and creosote bushes, with the tapioca (*Jatropha macrorhiza* Bentham) and several kinds of gourd (*Cucurbita fœtidissima* Humboldt, Bonpland, and Kunth; *C. digitata* Gray; *Apodanthera undulata* Gray, and a species of *Iberrillea*) in abundance. The plain and grassy hills surrounding White Water abound with aloe, *Nolina* or bear-grass, *Dasylirion*, yucca, acacia, senna, sumach, *Fallugia*, *Trixis*, and numerous species of cacti, among which are *Opuntia macrocentra* Engelmann, *O. arborescens* Engelmann, and the beautiful rainbow cactus (*Cereus pectinatus rigidissimus* Engelmann.

STATION No. 17—Eastern base of the San Luis Mountains. Monument No. 64 marks the lower timber line on the San Luis Mountains, which is the largest range crossed by the Mexican Boundary Line, and practically continuous with the Sierra Madre of Mexico. The monument is 255 kilometers (159 miles) from the Rio Grande, and has an elevation of 1,620 meters (5,315 feet), the highest neighboring peaks reaching 2,400 meters (7,874 feet), while Animas Peak, at the north extremity of the San Luis Range in New Mexico, is 2,677 meters (8,783 feet) in height. The forest trees at the lower timber line are mostly evergreen oak (*Quercus emoryi*), though there are cypress, walnut, cherry, sycamore, and gray oak (*Quercus grisea*) in the low canyons. The open country below the timber line is covered with grass, with occasional areas of mesquite and chaparral. This station was visited by me on June 2, 17, and 29, 1892, and I also camped there September 23 to 24, 1893.

STATION No. 18.—San Francisco Canyon, east side of San Luis Mountains, Chihuahua, Mexico. The camp was about 8 kilometers (5 miles) southwest of Monument No. 63, in the West Playas Valley. Altitude of station, 1,800 meters (5,906 feet). It was in a wooded canyon, beside a stream (San Francisco Water) that arises amid the high peaks of the San Luis, and was surrounded by cypress and other trees. The station was occupied by me from June 18 to 19 and 22 to 27, 1892; September 11, 1893. Mr. Holzner was there from June 22 to 27, 1892. Valuable collections were made here, as many of the species obtained belong to the Mexican fauna and flora, only crossing the United States line at a few points. The neighboring summits of the San Luis Mountains were visited from this camp.

STATION No. 19.—Summit of the San Luis Mountains. Monument No. 65 stands on the highest point crossed by the Boundary Line. It is 261 kilometers (162 miles) from the Rio Grande. The altitude at the monument is but 2,048 meters (6,719 feet); but neighboring peaks on the south are from 2,000 to 2,400 meters (6,562 to 7,874 feet), while the main Animas Peak, 29 kilometers (18 miles) to the north, reaches the height of 2,677 meters (8,783 feet).

The naturalists of Major Emory's survey of the Mexican Boundary Line usually referred to the San Luis and Animas peaks as the Sierra Madre, of which system they are in reality the most northern spur. They are to be regarded as the western border or rim of a canoe-shaped continental divide, the Quitman Range forming the eastern rim, and the Eastern Desert occupying the interior of the canoe, where it is cross sectioned by the Boundary Line. At the time that this survey was made a small band of Apaches, under a renegade Indian scout named Kid, frequented these mountains and terrorized the settlers of the surrounding country. Some of these Indians were twice seen in 1893 by members of our party, and their tracks were seen in the mountains during the summers of 1892 and 1893. For this reason, as well as on account of the absence of water and the difficulty of transportation, I did not attempt to establish a permanent collecting station at the summit of the San Luis Mountains. Stations No. 17, at the lower timber line on the east side, and No. 20 (at Monument No. 66) (Plate III, fig. 2), just below timber line on the west side, were occupied; and Station No. 18, in the cypress zone on the east, and a camp at the spring in Turkey Canyon, at a corresponding altitude on the west side, were centers of collecting activity for several weeks. During July, 1892, the writer, with the assistance of Lieut. Francis G. Irwin, explored the Animas and San Luis ridges from the San Luis Pass north to the second Animas Peak (altitude, 2,505 meters) and south to the heads of Cajon Bonito Creek, in Mexico. In addition to this, I made collections in the mountains on the following dates: May 31, 1892, crossed range at Cook Pass; June 2 and 29, 1892, crossed range at Irwin Pass, near the Boundary Line; June 1, 1892, explored Turkey Canyon to about 1 mile above the second spring; June 2, 17, and 29, 1892, eastern base, near the Boundary; June 18 to 19 and 22 to 27, 1892, San Francisco Canyon and adjacent portions of east slope from base to summit; July 5 and 19, 1892, west slope from base to summit; several visits were made during July, 1892, to Mr. Holzner's camp at the lower spring in Turkey Canyon; September 11, 1893, San Francisco Canyon, east side, from base to summit; September 24, 1893, Irwin Pass from Monument 64 to Monument 66; August 31 and September 1, 4, 5, 6, and 7, 1893, west side from base to summit, in the vicinity of Turkey Canyon; September 25, 26, 29, 30, and October 1 and 2, 1893, west slope of San Luis Mountains, sometimes touching the summit. Mr. Holzner collected birds and mammals on the east side of the San Luis Mountains, in San Francisco Canyon and its vicinity, June 22 to 27, 1892. From July 11 to 23 he camped at the lower spring in Turkey Canyon, on the west side of the range.

Flora of San Luis Mountains.—Many important plants are found in the vicinity of this station, as will be seen from the lists below.

These mountains are largely of calcareous rock, and are steep and much eroded. Where the rock is covered with soil they are wooded, from a well-marked lower timber line at about 1,600 meters, or 5,250 feet altitude, to the summit (altitude 2,400 meters, or 7,874 feet). A list of the trees is given below, their vertical range and relative abundance having been sufficiently commented on:

Pinus strobiformis Engelmann.
Pinus cembroides Zuccarini.
Pinus ponderosa Lawson.
Pinus mayriana Sudworth.
Pinus chihuahuana Engelmann.
Pseudotsuga mucronata (Rafinesque) Sudworth.
Cupressus arizonica Greene.
Juniperus monosperma (Engelmann) Sargent.

Juniperus pachyphlæa Torrey.
Yucca brevifolia Torrey.
Yucca constricta Buckley.
Juglans rupestris Engelmann.
Salix nigra Marshall.
Salix occidentalis longipes (Andersson) Bebb.
Populus fremontii Watson.
Quercus gambelii Nuttall.
Quercus oblongifolia Torrey.
Quercus arizonica Sargent.
Quercus reticulata Humboldt and Bonpland.
Quercus emoryi Torrey.
Quercus chrysolepis Liebmann.
Quercus hypoleuca Engelmann.
Celtis occidentalis Linnæus.
Morus celtidifolia Humboldt, Bonpland, and Kunth.
Platanus wrightii Watson.
Cercocarpus parvifolius paucidentatus Watson.
Prunus salicifolia Humboldt, Bonpland, and Kunth.
Prosopis glandulosa Torrey.
Robinia neomexicana Gray.
Acer saccharum grandidentatum (Nuttall) Sargent.
Rhamnus purshiana de Candolle.
Arbutus arizonica (Gray) Sargent.
Arctostaphylos pungens Humboldt, Bonpland, and Kunth.
Fraxinus velutina Torrey.

Most prominent of the shrubs and large plants are the following:

Yucca baccata Torrey.
Yucca glauca Nuttall.
Nolina texana Watson.
Nolina lindheimeriana (Scheele) Watson.
Dasylirion wheeleri Watson.
Agave palmeri Engelmann.
Berberis wilcoxii Kearney.
Holodiscus dumosus (Nuttall) Heller.
Whipplea utahensis Watson.
Ribes viscosissimum Pursh.
Rhus toxicodendron Linnæus.
Rhus trilobata Nuttall.
Rhamnus californica Eschscholtz.
Vitis arizonica Engelmann.
Opuntia lindheimeri Engelmann.
Rubus deliciosus neomexicanus (Gray) Kearney.
Fallugia paradoxa (D. Don) Endlicher.
Mimosa biuncifera Bentham.
Mimosa grahami Gray.
Mimosa dysocarpa Bentham.
Acacia filiculoides (Cavanilles) Trelease.
Erythrina flabelliformis Kearney.
Ptelea baldwinii Torrey and Gray.
Opuntia arborescens Engelmann.
Garrya wrightii Gray.
Symphoricarpos oreophilus Gray.
Lonicera ciliosa (Pursh) Poiret.
Baccharis glutinosa Persoon.

The Animas (meaning spirit) Range is a continuation of the San Luis Mountains, which, in turn, is connected with the Sierra Madre of Mexico. It lies wholly in New Mexico, the greater portion as well as all of the other higher peaks of the San Luis Mountains being in old Mexico. These two ranges are barely separated where the wagon road passes between them through San Luis Pass. The highest point of the pass is 122 meters (400 feet) higher than the Animas Valley at Monument No. 66 (aneroid readings two hours apart), giving it the altitude of 1,699 meters (5,574 feet). The trees of the Animas Mountains are the same as those of the San Luis Range, with the addition of a zone of aspen (*Populus tremuloides* Michaux) at the top. The main Animas Peak is a more evenly rounded conical or mound-like eminence than any of the peaks of the San Luis Range, and as a result of this the forest zones are better defined. The northeast side has the most timber, the west side being rocky and precipitous. At the summit *Populus tremuloides* and *Quercus gambelii* form a distinct forest zone, below which *Pseudotsuga mucronata* and *Pinus strobiformis* grow luxuriantly, and are bounded below by a zone of *Pinus ponderosa*, the base being wooded as in the San Luis Range.

The presence or absence of forests in this region depends upon the amount of moisture in the ground. This is illustrated by the accompanying diagram (fig. 2), showing the distribution of trees on the west side of the Animas Mountains. Below the timber line is a barren slope, several miles in extent, at the foot of which is a chain of springs, below these is a belt of fine oak timber (*Quercus emoryi* and *Q. arizonica*) which derives moisture from the springs just above them. The diagram also shows the downward prolongation of timber in moist canyons. This is especially noticeable in passing across San Luis Pass, which corresponds to the zone of *Quercus emoryi* and *Quercus arizonica*, to a broad valley east of the mountains, from which many lines of oak trees are seen extending down ravines from canyons in the San Luis Mountains; and in one instance a straggling line of oaks actually becomes continuous across the valley, joining one from a canyon in a mountain range to the eastward.

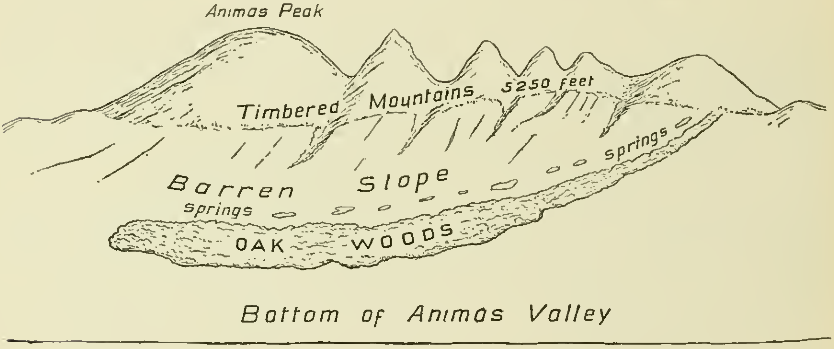
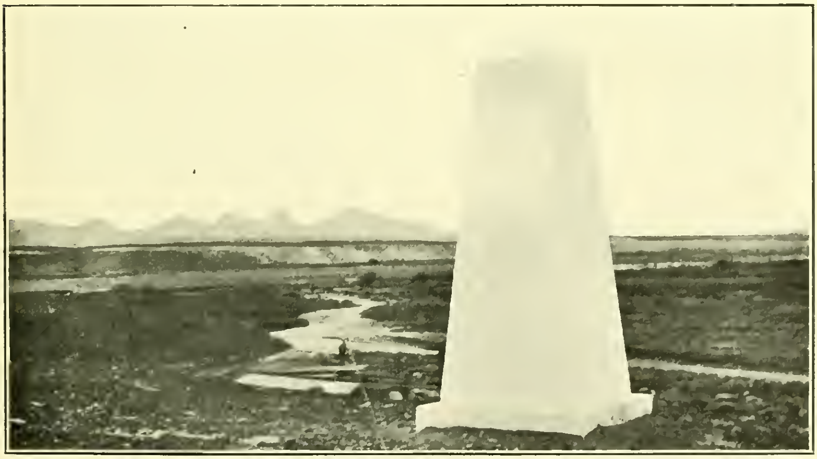


FIG. 2.—DISTRIBUTION OF TREES ON THE WEST SIDE OF THE ANIMAS MOUNTAINS.

STATION NO. 20.—San Luis Springs, Grant County, New Mexico. This is at present better known as Lang's Ranch, a famous camping place for Government troops in pursuit of hostile Indians. The springs, which are unfailing, are close to the Boundary at Monument No. 66, just below timber line of the western foot of the San Luis Mountains, and on the eastern edge of the broad Animas Valley. (Plate X, fig. 1.) Altitude, 1,577 meters (5,174 feet) at Monument No. 66. Game was abundant, and water and grazing good. On a preliminary reconnoissance in advance of the surveying parties, conducted by Lieut. D. D. Gaillard, commissioner, accompanied by the present writer and Lieut. Francis G. Irwin, camp was made at



1. Eastern Edge of Animas Valley (See Page 92).
2. San Pedro Valley (See Page 101).

San Luis Springs from May 31 to June 2, 1892. Though a purely business trip, occupying five days, made for the purpose of locating future camping grounds with the view to a supply of wood, water, and grass, game was so abundant that we killed seven antelope, two deer, two turkeys, two black timber wolves, and smaller game.

This station was occupied by me from May 31 to June 2, June 29 to July 1, July 4 to 16 and 18 to 28, 1892; August 31 to September 10, September 24 to October 2, 1893. Mr. Holzner was there from June 29 to July 11 and July 23 to 28, 1892. Collections were made in other parts of the Animas Valley and in the San Luis Mountains, as well as about the camp.

STATION NO. 21.—Head of Right Fork of Cajon Bonito Creek. This beautiful stream rises from springs at the side of a wooded canyon, at an altitude of about 1,375 meters (4,511 feet) 6 miles south of Monument No. 67. It constitutes one of the ultimate sources of the great Yaqui River of western Mexico. Collections of fishes, birds, mammals, plants, etc., were made by me from July 1 to 4, 21, and 23 to 24, 1892; September 8 and 27 to 28, 1893. The fauna and flora are largely Mexican. The fish are, of course, those of the Yaqui River. The Texas kingfisher, Mexican cliff swallow, and many other interesting species of the Mexican fauna were obtained. On the middle course of Cajon Bonito Creek, which is parallel to Guadalupe Canyon, in the vicinity of Monument No. 73, are numerous siliceous tree trunks, some of them delicately colored, but which crumble to pieces when struck by the hammer.

Vegetation.—In reaching the head of the Right Fork of Cajon Bonito Creek, the west foot of the San Luis Mountains is skirted from Lang's ranch to the south edge of the Animas Valley, crossing several points of oak timber—prolongations down shallow washes or canyons from the general timber line of the mountains. Tall nolinas cover much of this part of the Animas Valley. Numerous ravines extending from it to the Cajon canyon are wooded near the tops with oaks and alligator juniper, mixed lower down with one-seed juniper, sycamore, hackberry, walnut, wild china, desert willow, ash, mulberry and acacia, with an undergrowth of shrubs, yuccas, prickly pears, choya cacti, mescal, and nolinas. At the head of the stream are springs of rather warm water, and there are hot springs lower down, on the main Cajon Bonito Creek. The banks are forested with cottonwood, sycamore, maple, willows (*Salix nigra*, *S. occidentalis longipes*, and *S. taxifolia*), ash, mulberry, desert willow, cherry, walnut, and wild china, with here and there an alligator juniper, a one-seed juniper, or even a straggling Arizona cypress. The rocky acclivities support a growth of grapevines (*Vitis arizonica* Engelmann) and poison ivy (*Rhus toxicodendron* Linnæus), intermixed with cacti, mescal, dasylirions, yuccas, nolinas, shrubby sumachs, thorny mimosas (*Mimosa biuncifera* and *M. lindheimeri*), and bearberries (*Rhamnus purshiana*), together with innumerable bushes and herbs.

STATION NO. 22.—Animas Valley. This is a grassy, treeless plain, 272 kilometers (169 miles) from the Rio Grande. The astronomical camp was located at Monument No. 67, altitude 1,573 meters (5,161 feet), near the middle of it. At this point an enormous artificial dam stretches across the Animas Valley.[a] After heavy rains a large lake is formed, which is frequented by waterfowl and game of all kinds. I am indebted to the members of the astronomical party for numerous specimens, especially such as were drowned by a sudden flooding of the valley after a heavy rain. I crossed the Animas Valley seven times—July 6, 14, 18, and 28, 1892; August 30 and 31, and October 2, 1893. Mr. Holzner crossed it July 28, 1892.

STATION NO. 23.—Cloverdale, Grant County, New Mexico. Springs of pure cold water are found in a little valley among the hills east of the Animas Valley, only a few miles from the Arizona-New Mexico Line and 6 miles north of Monument No. 69. In a canyon a few miles south of Cloverdale is a larger spring and stream, emptying into Guadalupe Canyon, and much frequented by bear, deer, and other large game. I was in that place from July 14 to 18, 1892, collecting plants and animals.

Vegetation.—The region is more or less forested, the principal trees being Mexican piñon, Chihuahua pine, longstalk willow, Fremont cottonwood, blue oak, Emory oak, whiteleaf oak, Mexican walnut, and leatherleaf ash. Grape, mimosa, and mescal are also abundant.

STATION NO. 24.—Hall's Ranch, Guadalupe Canyon, Sonora, Mexico, altitude, 1,267 meters (4,157 feet). Camp was made at Monument No. 73, in the canyon, 293 kilometers (182 miles) from the Rio Grande. Occupied by myself, July 6 to 8, 28 to 29, and August 11, 1892; August 24 to 30, and October 2, 4, 1893; by Mr. Holzner July 28 and 29, 1892. The canyon is sparsely wooded with sycamore, red juniper, oak, ash, mulberry, and grape. Much of the rock is rhyolite and brown or yellowish andesitic basalt.

In the southeastern corner of Arizona, about 3 miles from Monument No. 73, a large deposit of Tertiary fossils was shown us by Mr. Hall. A few of them were brought away, but a very large quantity of beautifully preserved specimens were left on the spot, which I was unable to find again, though several days were subsequently spent in attempting to do so, Mr. Hall having been killed in the meantime.

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[a] For a description, with illustrations, of this gigantic aboriginal earthwork, by Capt. D. D. Gaillard, Corps of Engineers, U. S. Army, see the American Anthropologist for September, 1896.

Flora of Guadalupe Canyon.—Here the distribution of plant life is as follows:

The trees are:

Pinus cembroides Zuccarini.
Pinus chihuahuana Engelmann.
Juniperus monosperma (Engelmann) Sargent.
Juniperus pachyphlæa Torrey.
Yucca brevifolia Torrey.
Juglans rupestris Engelmann.
Salix nigra Marshall.
Salix occidentalis longipes (Andersson) Bebb.
Salix taxifolia Humboldt, Bonpland, and Kunth.
Populus wislizeni (Watson) Sargent.
Quercus oblongifolia Torrey.
Quercus arizonica Sargent.
Quercus emoryi Torrey.
Celtis occidentalis Linnæus.
Celtis reticulata Torrey.
Morus celtidifolia Humboldt, Bonpland, and Kunth.
Platanus wrightii Watson.
Vauquelinia californica (Torrey) Sargent.
Acacia constricta Bentham.
Prosopis sp.[a]
Sapindus marginatus Willdenow.
Arctostaphylos pungens Humboldt, Bonpland, and Kunth.
Bumelia rigida (Gray) Small.
Fraxinus velutina Torrey.
Chilopsis linearis (Cavanilles) Sweet.

Other conspicuous plants:

Selaginella rupestris (Linnæus) Spring.
Yucca baccata Torrey.
Nolina lindheimeriana (Scheele) Watson.
Dasylirion wheeleri Watson.
Agave schottii Engelmann.
Agave palmeri Engelmann.
Mimosa grahami Gray.
Erythrina flabelliformis Kearney.
Fouquieria splendens Engelmann.
Rhus toxicodendron Linnæus.
Rhus virens Lindheimer.
Rhus glabra Linnæus.
Mortonia scabrella Gray.
Vitis arizonica Engelmann.
Parthenocissus quinquefolia (Linnæus) Planchon.
Cactus (several species).
Echinocactus (several species).
Opuntia (several species).
Ibervillea lindheimeri (Cogniaux) Greene.
Baccharis glutinosa Persoon.

STATION NO. 25.—San Bernardino Ranch. Camp was made at Monument No. 77, in a mesquite flat between the San Bernardino Springs and the neighboring San Bernardino River, 310 kilometers (193 miles) from the Rio Grande, at an altitude of 1,133 meters (3,717 feet). The rock is rhyolite and basalt. The San Bernardino River (head of the Yaqui), rising in Arizona, is wooded with willow, cottonwood, boxelder, ash, and mesquite; a few red junipers grow on the adjacent hills; and the creosote bush, mesquite, acacia, and ocotillo occupy the stony mésas and arroyos which constitute the major portion of the region. The broad meadows below the San Bernardino Springs are now covered by grazing herds; but at the time of Emory's Survey they were occupied by a dense growth of cane.

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[a] The Yaqui Basin form of mesquite replaces *Prosopis glandulosa* Torrey west of the San Luis Mountains, entering Guadalupe Canyon from the Animas Valley. It was found as high as 1,623 meters (5,325 feet), extending through the canyon to the San Bernardino River, where fine mesquite trees were found in the river bottom at the altitude of 1,189 meters (3,900 feet).

which has since entirely disappeared. Waterfowl were abundant along the San Bernardino River and on the marshy meadows and pools below the springs. Archeological objects and rocks, plants, mollusks, fishes, reptiles, batrachians, birds, and mammals were collected. The writer was present at this station July 6 and 7, July 29 to September 11, 1892; August 17 to 24 and October 4 to 7, 1893. Mr. Holzner, July 29 to September 11, 1892.

Flora of San Bernardino River.—The principal trees and plants found in this vicinity are given in the lists that follow.

The trees are:

Juniperus monosperma (Engelmann) Sargent.
Fraxinus velutina Torrey.
Salix nigra Marshall.
Salix occidentalis longipes (Andersson) Bebb.
Salix taxifolia Humboldt, Bonpland, and Kunth.
Platanus wrightii Watson.
Yucca brevifolia Torrey.
Morus celtidifolia Humboldt, Bonpland, and Kunth.
Populus fremontii Watson.
Acacia constricta Bentham.
Eysenhardtia orthocarpa (Gray) Watson.
Prosopis sp.
Holacantha emoryi Gray.
Acer negundo Linnæus.
Sapindus marginatus Willdenow.
Bumelia rigida (Gray) Small.
Celtis reticulata Torrey.
Chilopsis linearis (Cavanilles) Sweet.
Nicotiana glauca Graham.

Other conspicuous plants are:

Ephedra sp.
Scirpus olneyi Gray.
Scirpus californicus (Meyer) Britton.
Yucca baccata Torrey.
Agave palmeri Engelmann.
Atriplex sp.
Argemone platyceras Link and Otto.
Ribes aureum Pursh.
Mimosa (several species).
Cassia leptocarpa Bentham.
Cassia wislizeni Gray.
Fouquieria splendens Engelmann.
Covillea tridentata (de Candolle) Vail.
Rhus toxicodendron Linnæus.
Rhus trilobata Nuttall.
Cereus greggi Engelmann.
Opuntia (several species).
Baccharis glutinosa Persoon.
Perezia nana Gray.
Cucurbita fœtidissima Humboldt, Bonpland, and Kunth.
Cucurbita digitata Gray.

STATION No 26.—Near the mouth of Cajon Bonito Creek, Sonora, Mexico. Altitude, 975 meters (3,199 feet). Cajon Bonito Creek, a terminal twig of the Yaqui River, debouches into the San Bernardino River 10 miles south of Monument No. 77 of the Mexican Boundary. The writer, acompanied by Lieut. D. D. Gaillard, camped there from August 31 to September 1, 1892, when driven out by the sudden flooding of the valley, caused by a cloudburst at the head of the stream, in the San Luis Mountains. I had experienced a similar occurrence in a canyon at the head of the Cajon Bonito Creek, where Col. J. W. Barlow and myself were encamped at the beginning of the storm season.

STATION No. 27.—Niggerhead, Cerro Gallardo. Monument No. 82. Altitude, 1,374 meters (4,508 feet). Distance from the Rio Grande, 326 kilometers (202 miles). A hilly region, covered with volcanic scoria, sparsely clothed with grass and brushwood, with a few red juniper trees. Within a radius of a dozen kilometers (7 miles) a range of altitude from 1,200 to 1,640 kilometers (3,940 to 5,380 feet) could be found. Station occupied by myself September 1 and 11, 1892; August 14 to 17; and October 7, 1893. Plants, birds, etc., were collected.

Flora of Cerro Gallardo.—The trees and plants obtained near this station are named in the following lists.

The trees are:

Juniperus monosperma (Engelmann) Sargent.
Yucca brevifolia Torrey.
Salix laxifolia Humboldt, Bonpland, and Kunth.
Quercus arizonica Sargent.
Celtis reticulata Torrey.
Morus celtidifolia Humboldt, Bonpland, and Kunth.
Platanus wrightii Watson.
Acacia constricta Bentham.
Acacia greggii Gray.
Prosopis sp.
Eysenhardtia orthocarpa (Gray) Watson.
Kœberlinia spinosa Zuccarini.
Sapindus marginatus Willdenow.
Bumelia rigida (Gray) Small.
Fraxinus velutina Torrey.

Other shrubs and conspicuous plants are:

Ephedra trifurca Torrey.
Yucca baccata Torrey.
Nolina lindheimeriana (Scheele) Watson.
Dasylirion wheeleri Watson.
Agave palmeri Engelmann.
Cucurbita fœtidissima Humboldt, Bonpland, and Kunth.
Cucurbita digitata Gray.
Apodanthera undulata Gray.
Mimosa biuncifera Bentham.
Mimosa lindheimeri Gray.
Mimosa dysocarpa Bentham.
Mimosa grahami Gray.
Acacia filiculoides (Cavanilles) Trelease.
Cassia wislizeni Gray.
Erythrina flabelliformis Kearney.
Krameria parvifolia Bentham.
Fouquieria splendens Engelmann.
Covillea tridentata (de Candolle) Vail.
Rhus virens Lindheimer.
Opuntia of subgenera *Platopuntia* and *Cylindropuntia*.
Baccharis glutinosa Persoon.

STATION NO. 28.—Agua Prieta Ranch, Piedras Negras, Sulphur Spring Valley. Monument No. 85, distant from the Rio Grande 338 kilometers (210 miles). Altitude, 1,204 meters (3,950 feet). Occupied by myself September 11 and 12, 1892; August 14; and October 7, 1893; by Mr. Holzner, September 11 to 12, 1892. This broad valley, though crossed several times, was not carefully examined, and the collections made were small.

Vegetation.—The ground is part bare and part grassy, with extensive patches of the gregarious creosote bush (*Covillea tridentata*), and considerable greasewood (*Atriplex*), with some cacti. Soapweed (*Yucca glauca*) and a narrow-leaved yucca having a long caudex were sometimes seen; and some superb hackberry trees formed a grove on an arroyo at the west side of Sulphur Spring Valley, at the altitude of 1,400 meters (4,600 feet). Mesquites, acacias, and mimosas were locally numerous.

Station No. 29.—Dutch Charley's Ranch, 1 kilometer (¾ mile) north of Monument No. 88, and 355 kilometers (221 miles) from the Rio Grande. Altitude, 1,316 meters (4,318 feet). A small pool at Dutch Charley's Ranch usually contains a good supply of water, and the bushes and sedges around it shelter birds and mammals. The region is treeless, except for a few juniper and hackberry trees in arroyos from the Mule Mountains. On the surrounding hills the soil is loose and ashy, in places piled with scoria, or covered with brushwood. The locality was visited by Mr. Holzner, September 12, 1892, and by myself, September 12, 1892, August 12 to 14, and October 7 to 8, 1893. Small collections were made.

Vegetation.—*Covillea tridentata* and *Fouquieria splendens* cover much of the region. Gourds (*Cucurbita digitata*, *C. fœtidissima*, and *Apodanthera undulata*) are numerous; and the thickets about rocky hills are composed principally of woody cactus (*Opuntia leptocaulis*), prairie acacia (*Acacia filiculoides*), senna (*Cassia wislizeni*), mimosas (several species), and low yuccas. Mescal (*Agave palmeri*) is also abundant.

Station No. 30.—Johnston's Ranch, near Monument No. 90, 363 kilometers (225 miles) from the Rio Grande. Altitude 1,390 meters (4,561 feet). This station is at the south end of the Mule Mountains and 14 kilometers (9 miles) nearly south of the mining town of Bisbee, Arizona. Occupied by myself, September 12 to October 2, and October 7 to 10, 1892; August 12 and October 8, 1893; by Mr. Holzner, September 12 to October 2, and October 7 to 10, 1892. The plain on the south and the Mule Mountains on the north are extremely barren. A few trees grew along an arroyo and beside two little artificial ponds, supplied by wells and windmills, for the use of cattle. The collections consisted chiefly of birds, mammals, and plants; also accessories for mammal groups to be prepared at the U. S. National Museum.

Flora of Mule Mountains.—In the lists that follow the principal varieties of plant life found near this station are given.

The trees are:

Juniperus monosperma (Engelmann) Sargent.
Yucca brevifolia Torrey.
Juglans rupestris Engelmann.
Salix nigra Marshall.
Salix taxifolia Humboldt, Bonpland, and Kunth.
Populus fremontii Watson.
Quercus oblongifolia Torrey.
Quercus toumeyi Sargent.
Celtis reticulata Torrey.
Morus celtidifolia Humboldt, Bonpland, and Kunth.
Platanus wrightii Watson.
Acacia constricta Bentham.
Acacia greggii Gray.
Prosopis glandulosa Torrey.
Acer negundo Linnæus.
Sapindus marginatus Willdenow.
Arbutus arizonica (Gray) Sargent.
Chilopsis linearis (Cavanilles) Sweet.

Other shrubs and conspicuous plants are:

Ephedra trifurca Torrey.
Yucca baccata Torrey.
Nolina lindheimeriana (Scheele) Watson.
Dasylirion wheeleri Watson.
Agave palmeri Engelmann.
Atriplex sp.
Mimosa biuncifera Bentham.
Mimost dysocarpa Bentham.
Mimosa lindheimeri Gray.
Mimosa grahami Gray.
Cassia leptocarpa Bentham.
Cassia wislizeni Gray.
Erythrina flabelliformis Kearney.
Fonquieria splendens Engelmann.
Anisacanthus thurberi Gray.
Cucurbita fœtidissima Humboldt, Bonpland, and Kunth.
Cucurbita digitata Gray.
Baccharis glutinosa Persoon.
Hymenoclea monogyra Torrey and Gray.

Station No 31.—Bisbee, Arizona, 13 kilometers (8 miles) north of Monument No. 91, at an altitude of 1,700 meters (5,578 feet). The town occupies a section of a steep and rugged canyon of the Mule Mountains, whose neighboring peaks rise to the altitude of 2,172 meters (7,126 feet). The mountains are sparsely wooded with oak, red juniper, boxelder, hackberry, sycamore, walnut, and desert willow trees. Mammals, birds, and plants were collected in September, 1892, and October, 1893, by myself and Mr. Holzner. A series of specimens of copper and associated minerals was secured for the U. S. National Museum, through the liberality of the managers of the Copper Queen Mine, which is at Bisbee.

Station No. 32.—San Jose Mountain, Sonora, Mexico. From a base level of 1,308 meters (4,265 feet) this mountain rises abruptly to the height of 2,541 meters (8,337 feet). Timber line begins near the true base of the cone on the north side, but considerably higher on the south. The principal peak is about 8.5 kilometers (5.25 miles) south of Monument No. 93 and 386 kilometers (240 miles) west of the Rio Grande (measured on the Boundary Line). This mountain is wooded with aspen and deciduous white oak at the summit, with zones of Arizona pine, checkerbark juniper, and evergreen oak below. The arboreal and low vegetation are quite varied, but water exists in small and uncertain amounts. The writer ascended the main San Jose Peak, in company with Lieut. William P. Jackson, on September 26, 1892, and established Mr. Holzner in a camp at Gallina Springs, in a canyon on the northeast side of the mountain. This camp he again visited, replacing Mr. Holzner, on October 1, 1882. On August 4, 1893, I ascended the two highest peaks from the southwest. On August 5, 1893, Lieut. George H. McMaster and myself ascended the main peak from the north side, near Monument No. 93, and established a camp at a small spring on the north side at an altitude of 1,830 meters (6,000 feet), from which point I made daily excursions from the base of the mountain to its main summit, and trapped for mammals until August 12. Important collections were made at this station.

Flora of San Jose Mountains.—The plant life of these mountains is given in the lists that follow.

The trees are:

Pinus strobiformis Engelmann.
Pinus cembroides Zuccarini.
Pinus arizonica Engelmann.
Pinus ponderosa Lawson.
Pinus chihuahuana Engelmann.
Abies concolor (Gordon) Parry.
Juniperus pachyphlœa Torrey.
Yucca brevifolia Torrey.
Juglans rupestris Engelmann.
Salix nuttallii Sargent.
Populus tremuloides Michaux.
Populus fremontii Watson.
Quercus gambelii Nuttall.
Quercus oblongifolia Torrey.
Quercus arizonica Sargent.
Quercus emoryi Torrey.
Quercus hypoleuca Engelmann.
Morus celtidifolia Humboldt, Bonpland, and Kunth.
Platanus wrightii Watson.
Cercocarpus parvifolius paucidentatus Watson.
Prunus salicifolius Humboldt, Bonpland, and Kunth.
Acacia greggii Gray.
Acacia constricta Bentham.
Prosopis glandulosa Torrey.
Robinia neomexicana Gray.
Ptelea trifoliata Linnæus.
Acer saccharum grandidentatum (Nuttall) Sudworth.
Acer negundo Linnæus.
Sapindus marginatus Willdenow.
Arbutus arizonica (Gray) Sargent.
Arctostaphylos pungens Humboldt, Bonpland, and Kunth.
Rhamnus purshiana de Candolle.
Fraxinus velutina Torrey.
Chilopsis linearis (Cavanilles) Sweet.
Sambucus mexicana Presl.

Neither *Pseudotsuga mucronata* nor *Cupressus arizonica* were found on the San José Mountains.

Other shrubs and conspicuous plants are:

Ephedra trifurca Torrey.
Yucca glauca Nuttall.
Nolina lindheimeriana (Scheele) Watson.
Dasylirion wheeleri Watson.
Berberis wilcoxii Kearney.
Holodiscus dumosus (Nuttall) Heller.
Philadelphus microphyllus Gray.
Rubus deliciosus neomexicanus (Gray) Kearney.
Fallugia paradoxa (D. Don) Endlicher.
Rosa fendleri Crépin.
Mimosa biuncifera Bentham.
Mimosa dysocarpa Bentham.
Mimosa grahami Gray.
Mimosa lindheimeri Gray.
Arnott.
Ptelea baldwinus Torrey and Gray.
Rhus toxicodendron Linnæus.
Rhus trilobata Nuttall.
Rhus virens Lindheimer.
Ceanothus integerrimus Hooker and Arnott.
Vitis arizonica Engelmann.
Parthenocissus quinquefolia (Linnæus) Planchon.
Opuntia and other cacti.
Garrya wrightii Torrey.
Symphoricarpos oreophilus Gray.

The slender blue racer snake was found at the monument on the summit of San Jose Peak; and the beautiful *Elaps euryxanthus* of Kennicott was taken at my camp near the north base of the mountain, at the altitude of 1,830 meters (6,000 feet).

STATION No. 33.—Johnston's Steam Pump, near Monument No. 93. Altitude, 1,298 meters (4,259 feet). The country about this camp is treeless and grassy, with occasional areas of creosote and other bushes. Unimportant collections were made by myself and Mr. Holzner, on October 10, 1892, and by myself August 2 to 5, 1893.

STATION No. 34.—San Pedro River at Monument No. 98, 395 kilometers (245 miles) west of the Rio Grande. Altitude, 1,298 meters (4,259 feet). The San Pedro River at this point is a good-sized stream, containing many fish, batrachians, and turtles, and its waters and banks are inhabited by numerous aquatic species of mammals and birds. There are, however, no meadows or marshes of any considerable extent along its banks in this part of its course. Trees are limited to the edge of the stream, where willow, ash, boxelder, cottonwood, and mesquite are the common species. (Plate X, fig. 2.) The adjacent Huachuca Mountains, of Arizona, crossed at their southern extremity by the International Boundary Line some 13 kilometers (8 miles) to the westward, are well wooded to the base. I was at this station from October 10 to November 1, 1892; July 27 to August 2, and October 10, 1893. Mr. Holzner, from October 10 to November 2, 1892. Important collections were made.

Flora of San Pedro Valley.—The collections of plants made near Monument No. 98 includes the varieties indicated in the lists below.

The trees are:

Juglans rupestris Engelmann.
Salix nigra Marshall.
Salix occidentalis longipes (Andersson) Bebb.
Salix taxifolia Humboldt, Bonpland, and Kunth.
Populus fremontii Watson.
Celtis reticulata Torrey.
Morus celtidifolia Humboldt, Bonpland, and Kunth.
Platanus wrightii Watson.
Acacia greggii Gray.
Acacia constricta Bentham.
Prosopis glandulosa Torrey.
Acer negundo Linnæus.
Sapindus marginatus Willdenow.
Fraxinus velutina Torrey.
Chilopsis linearis (Cavanilles) Sweet.

Other conspicuous vegetation includes:

Yucca glauca Nuttall.
Atriplex sp.
Rhus glabra Linnæus.
Mimosa dysocarpa Bentham.
Acacia filiculoides (Cavanilles) Trelease.
Covillea tridentata (de Candolle) Vail.
Opuntia (several species).
Cucurbita fœtidissima Humboldt, Bonpland, and Kunth.
Apodanthera undulata Gray.
Perezia sp.

STATION No. 35.—Huachuca Mountains, Arizona. This isolated but extensive range (called Sierra Espuela by the early explorers) rises from a base level of 1,275 meters (4,183 feet) to the height of 2,887 meters (9,472 feet). It is almost wholly within the United States, extending nearly north from Monument No. 102 for a distance of 32 kilometers (20 miles). It is 407 kilometers (253 miles) west of the Rio Grande. The highest point, Hasslops Peak, is 14½ kilometers (9 miles) north of the Mexican line. The higher timber line is not reached by any of the mountains visible from the Mexican Boundary Line. In the Huachuca range the lower timber line descends to the edge of the surrounding plain on all sides and sends several wooded prolongations downward, in canyons, several miles across the bare plains toward the San Pedro River. The principal canyons on the east side of the range contain spring-fed streams of clear, cold water—the best that we found between the Coast Range and the Rio Grande. The stream in Tanners Canyon contains fish. (Plate XI, fig. 1.)

I was on the summit of Hasslops Peak (altitude 2.887 kilometers, or 9,472 feet) October 21 and 26, 1892; also July 31 and October 17, 1893. During October, 1892, and July, 1893, I explored the whole east side of the range from Igos Ranch on the north to Monument 102 on the south. This field appeared to be so rich that, in July, 1893, it was decided to detach Mr. Holzner from the Monument-Building Party, which was necessarily accompanied by myself, from the San Pedro River (Monument No. 98) eastward to the eastern end of the boundary parallel 31° 20′ (Monument No. 53), a region that had been previously explored, in order to have him run a careful line from the base to the summit of the Huachuca Mountains, which he accomplished satisfactorily between July 24 and October 10, 1893. In this, great assistance was rendered by the commanding officers and post surgeon (Maj. Timothy E. Wilcox) at Fort Huachuca. Mr. Holzner's first camp was established near the lower timber line, in Tanners Canyon, where the "post garden" is situated, on July 24, 1893. His line of mammal traps was gradually extended upward through Tanners Canyon to the post sawmill, to which point his camp was moved in August. From this point trapping was extended to the summit of the range, and his camp was again moved from the sawmill to a spring near the summit of a high peak, which overlooks Ramsey Canyon, on September 10. On September 30, 1893, the weather having become severely cold at the summit, Mr. Holzner's camp was removed to the post garden, in Tanners Canyon, where he remained until October 10, 1893, when he rejoined the writer at Fort Huachuca. Camps were made at the Post Spring, near Fort Huachuca, and at Frauds Ranch, in Millers Canyon, from October 10 to 18, 1893. A complete circuit of these mountains was made, and collections made on all sides of the range. Mr. Holzner collected 207 mammals, 315 birds, and a few plants and land shells in the Huachuca Mountains, between July 24 and October 9, 1893. His work showed commendable enterprise and industry.

Flora of Huachuca Mountains.—Much effort was devoted to collecting and studying the fauna and flora of these mountains by Major Timothy E. Wilcox, who was for several years stationed at Fort Huachuca, and whose name must ever be associated with the botany of the western part of the United States. The elaborate list by N. L. Britton and T. H. Kearney, jr., and the collections made by

1. View Down Millers Canyon, Huachuca Mountains (See Page 102).
2. Patagonia Mountains, Showing Emory Oaks (See Page 105).

Major Wilcox in the Huachuca Mountains,[a] leave little to be desired more than to separate the trees, as follows:

Pinus strobiformis Engelmann.
Pinus cembroides Zuccarini.
Pinus arizonica Engelmann.
Pinus ponderosa scopulorum S. Watson.
Pinus mayriana Sudworth.
Pinus chihuahuana Engelmann.
Pseudotsuga mucronata (Rafinesque) Sudworth.
Juniperus monosperma (Engelmann) Sargent.
Juniperus pachyphlœa Torrey.
Yucca constricta Buckley.
Juglans rupestris Engelmann.
Salix nigra Marshall.
Salix ocidentalis longipes (Andersson) Bebb.
Salix lasiolepis Bentham.
Salix taxifolia Humboldt, Bonpland, and Kunth.
Populus tremuloides Michaux.
Populus fremontii Watson.
Quercus gambelii Nuttall.
Quercus undulata Torrey.
Quercus oblongifolia Torrey.
Quercus arizonica Sargent.
Quercus reticulata Humboldt and Bonpland.
Quercus emoryi Torrey.
Quercus chrysolepis Liebmann.
Quercus hypoleuca Engelmann.
Celtis occidentalis Linnæus.
Celtis reticulata Torrey.
Morus celtidifolia Humboldt, Bonpland, and Kunth.
Platanus wrightii Watson.
Cercocarpus breviflorus Gray.
Cercocarpus parvifolius paucidentatus Watson.
Prunus salicifolia Humboldt, Bonpland, and Kunth.
Acacia greggii Gray.
Acacia constricta Bentham.
Prosopis glandulosa Torrey.
Robinia neomexicana Gray.
Ptelea trifoliata Linnæus.
Acer saccharum grandidentatum (Nuttall) Sudworth.
Acer negundo Linnæus.
Sapindus marginatus Willdenow.
Arbutus arizonica (Gray) Sargent.
Arctostaphylos pungens Humboldt, Bonpland, and Kunth.
Rhamnus purshianus de Candolle.
Fraxinus cuspidata Torrey.
Fraxinus velutina Torrey.
Chilopsis linearis (Cavanilles) Sweet.
Sambucus mexicana Presl.

Fauna of Huachuca Mountains.—Many field naturalists have visited this beautiful mountain range, but it continues to yield rare and novel forms of animal life whenever explored. Unfortunately, Mr. Holzner reached the Huachucas (July 24) after the breeding-season of birds was over, and in a year of phenomenal dryness, when old pine trees died of drought, and birds were obliged to forsake their usual haunts on account of lack of water to drink. This likewise operated to increase the difficulty of finding land-shells, although the molluscan fauna is rich. Mr. Holzner obtained a new rabbit (*Lepus floridanus holzneri*) and a new pocket-gopher (*Thomomys fulvus intermedius*) from the aspen zone at the top; and his collections contain fine series of several rare animals. Of batrachians, only a toad, tree-frog, and a frog (*Rana virescens brachycephala* Cope) were observed. Principally through the exertions of Maj. Timothy E. Wilcox and, to a less extent, those of Drs.

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[a] Trans. N. Y. Acad. Sci., XIV, pp. 21–44, issued October 22, 1894.

A. K. Fisher and Leonhard Stejneger, Lieut. Harry C. Benson, J. Alden Loring, W. W. Price, Frank X. Holzner, and the author, the following-named reptiles from the Huachuca Mountains are represented in the U. S. National Museum collection:[a]

Lizards.

Crotaphytus collaris (Say).
Callisaurus draconoides ventralis (Hallowell).
Holbrookia maculata maculata Girard.
Uta symmetrica Baird.
Sceloporus jarrovii Cope.
Sceloporus torquatus poinsettii (Baird and Girard).
Sceloporus clarkii Baird and Girard.
Phrynosoma douglassii hernandesi (Girard).
Phrynosoma orbiculare (Cuvier).
Phrynosoma cornutum (Harlan).
Cnemidophorus gularis gularis Baird and Girard.

Snakes.

Diadophis regalis regalis Baird and Girard.
Salvadora grahamiæ Baird and Girard.
Pityophis sayi sayi (Schlegel).
Ophibolus pyrrhomelas Cope.
Ophibolus getulus boylii (Baird and Girard).
Rhinochilus lecontei Baird and Girard.
Eutænia eques eques (Reuss).
Zamenis flagellum flagellum (Shaw).
Zamenis semilineatus Cope.
Trimorphodon lyrophanes Cope.
Tantilla nigriceps Kennicott.
Elaps euryxanthus Kennicott.
Sistrurus catenatus edwardsii (Baird and Girard).
Crotalus molossus Baird and Girard.
Crotalus adamanteus scutulatus (Kennicott).
Crotalus adamanteus atrox (Baird and Girard).
Crotalus pricei Van Denburgh.
Crotalus lepidus Kennicott.

The turtles of the Huachuca Mountains comprise the common box-tortoise of the region, the Arizona mud turtle (*Kinosternon sonoriense* Le Conte), and a third, unidentified species, taken from the neighboring San Pedro River.

Station No. 36.—Cienaga, Babacomari Creek, Cochise County, Arizona. Mearns and Holzner: October 18 and 19, 1893. The stream was followed from where it debouches into the San Pedro River to the springs and Cienega at its head, which is about 32 kilometers (20 miles) north of Monument No. 106. It is inhabited by fishes and such aquatic mammals as the cotton rat, muskrat, and beaver, and in winter becomes the resort of many wading and swimming birds.

Vegetation.—The trees were willows (*Salix nigra*, *S. occidentalis*, and *S. taxifolia*), Mexican mulberry (*Morus celtidifolia*), mesquite (*Prosopis glandulosa*), devils claws (*Acacia greggii*), boxelder (*Acer negundo*), wild china (*Sapindus marginatus*), and leatherleaf ash (*Fraxinus velutina*). On the banks is a dense growth of *Aster spinosus* Bentham; and on the hills are fine groups of *Agave applanata huachucensis* (Baker) Mulford.

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[a] Since this was written Dr. Leonhard Stejneger has published an elaborate paper on The Reptiles of the Huachuca Mountains, Arizona, Proc. U. S. Nat. Mus., XXV, 1902, pp. 149 to 158.

STATION No. 37.—Santa Cruz Valley, near La Noria, Pima County, Arizona. Mr. Holzner made a careful examination of the fauna of this station from November 5 to 14 and 22 to December 5, 1892; also October 19 to 20, 1893, during which periods he was encamped beside the Santa Cruz River at Monument No. 111, 437 kilometers (271 miles) from the Rio Grande, at an altitude of 1,390 meters (4,570 feet). The Santa Cruz or San Rafael Valley at this point is a broad and treeless plain, covered with grass, stretching between the Patagonia Mountains on the west and the Huachuca and Santa Cruz mountains on the east. The camp of the old Boundary Survey, under Major Emory, was located on almost the same ground as that occupied by Mr. Holzner, whose collections of birds, mammals, and fishes were of unusual value. On October 19, 1893, I placed a line of mammal traps between Monument No. 111 and the town of Santa Cruz, Sonora, to which latter point they were removed on the following day.

STATION No. 38.—Patagonia Mountains. Mr. Holzner occupied a station at the summit of these mountains, south of Monument No. 114, 448 kilometers (278 miles) from the Rio Grande, at an altitude of 1,750 meters (5,742 feet), from November 14 to 20 and 27, 1892. The section of the Patagonia Mountains south of the Boundary Line is called " Sierra de San Antonio." These ranges are well wooded and contain springs of good water. (Plate XI, fig. 2.) From a base-level of 1,130 meters (3,708 feet) they rise to the height of 2,217 meters (7,274 feet). Mr. Holzner obtained an interesting series of mammals and birds in them. The flora is similar to that of the Huachuca Mountains at corresponding altitudes.

STATION No. 39.—Town of Santa Cruz, Sonora, Mexico. The writer, accompanied by Mr. Holzner, camped in the town, beside the Santa Cruz River, about 12 kilometers (7.5 miles) south of Monument No. 111, from October 20 to 23, 1893. The river at this place enters a defile between the mountains, and, bending around the Mexican section of the Patagonia Mountains (Sierra de San Antonio), it turns and flows northward to the Gila River. The narrow valley in which Santa Cruz lies is under thorough cultivation, and is covered with beautiful gardens and orchards on either side of the town. The alcalde paid his respects to us promptly, gave us a cordial welcome, and personally assisted us in making collections. On every hand we received friendly services and full liberty to collect specimens wherever they could be found, in return for which favors it was a pleasure to render such assistance as lay in our power to some of the sick of the village who were commended to us by our friend the alcalde.

Among the interesting specimens collected were topotypes of *Hesperomys sonoriensis* Le Conte.

Flora of the town of Santa Cruz, Sonora.—Besides the products of orchards, fields, and gardens, the trees and coarser plants in the immediate vicinity are:

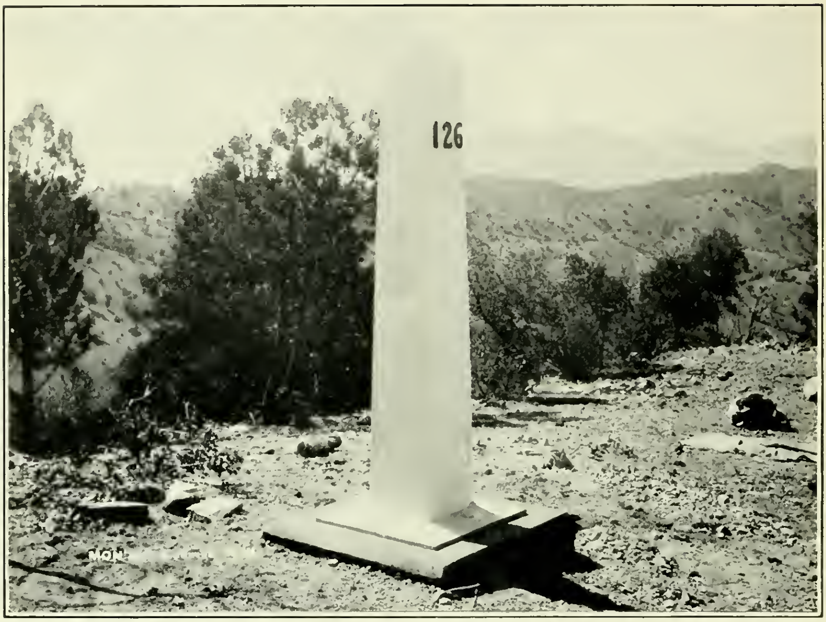
Juniperus pachyphlœa Torrey.
Yucca brevifolia Torrey.
Juglans rupestris Engelmann.
Salix occidentalis longipes (Andersson) Bebb.
Salix taxifolia Humboldt, Bonpland, and Kunth.
Populus fremontii Watson.
Quercus arizonica Sargent.
Quercus oblongifolia Torrey.
Celtis occidentalis Linnæus.
Morus celtidifolia Humboldt, Bonpland, and Kunth.
Platanus wrightii Watson.
Prosopis glandulosa Torrey.
Acer negundo Linnæus.
Arctostaphylos pungens Humboldt, Bonpland, and Kunth.
Sambucus glauca Nuttall.

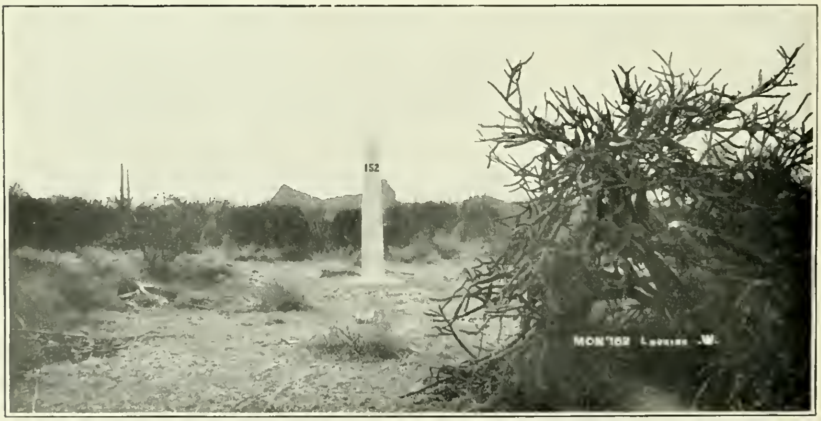
The banks and thickets were covered with grape (*Vitis arizonica* Engelmann), the hills with dasylirion (*Dasylirion wheeleri* Watson), and an abundance of the buffalo currant (*Ribes aureum* Pursh) grew along the Santa Cruz River banks, together with the usual complement of dock, cocklebur, gourd, and spiny aster. Level and waste places bordering the river are sometimes covered with the prickly Mexican poppy (*Argemone mexicana* Linnæus).

Station No. 40.—Santa Cruz River at Monument No. 118 (west of the Patagonia Mountains). Mr. Holzner camped from May 26 to July 10, 1893, near Monument No. 118, 461 kilometers from the Rio Grande, at an altitude of 1,130 meters (3,708 feet), and collected 14 mammals and 379 birds.

Station No. 41.—Road-crossing of the Santa Cruz River, Sonora, Mexico, 2 kilometers (1.5 miles) south of Monument No. 118. The river is heavily wooded with cottonwood, willow, walnut, very tall mesquites, and other trees. Altitude, about 1,140 meters (3,740 feet). Occupied by Mearns and Holzner on October 23 and 24, 1893, when plants, birds, and mammals were collected.

Station No. 42.—Nogales, Arizona. Monument No. 122. Altitude, 1,174 meters (3,852 feet). Distance from the Rio Grande, measured on the Mexican Boundary Line, 469 kilometers (292 miles); distance from the Colorado River, measured on the Mexican Boundary Line, 389 kilometers (242 miles). The grove of walnut found by Major Emory's party on Nogales Creek is now replaced by the thriving town of Nogales, to which the walnut trees gave name. Monument No. 122 stands on the north side of International Street. Mr. Holzner collected nine birds and one deer at Nogales in December and January, 1892; also 55 birds from April 14 to May 24, 1893. Assisted by Mr. Holzner, I made collections there from October 24 to 28, 1893. In the Pajaritos Mountains, at Nogales, intrusive rock appeared in the form of a coarse granite, of which




152
MON 152 Looking W.

1. Monument No. 126, Elevated Central Tract (See Page 107).
2. Western Part of Elevated Central Tract (See Page 114).

most of the mountain masses to the westward are composed, until, in the Coast Range of California, it is replaced by fine-grained granite. The Pajaritos also contain effusive rocks—rhyolite and basalt—in abundance.

Fauna of Nogales.—Owing to its location on the International Boundary and the only railroad that enters Mexico west of the Rio Grande, this station has attracted several trained field naturalists, among them Mr. P. L. Jouy, to whose efforts I am mainly indebted for the following list of the reptiles hitherto collected at Nogales:

Terrapene sp.
Kinosternon sonoriense Le Conte.
Ctenosaura multispinis Cope.
Crotaphytus collaris (Say).
Crotaphytus wislizenii Baird and Girard.
Uta stansburiana Baird and Girard.
Uta symmetrica Baird.
Sceloporus jarrovii Cope.
Sceloporus torquatus poinsettii Baird and Girard.
Sceloporus clarkii Baird and Girard.
Phrynosoma cornutum (Harlan).
Anota modesta (Girard).
Eublepharis variegatus (Baird).
Cnemidophorus gularis gularis Baird and Girard.
Salvadora grahamiæ Baird and Girard.
Rhinochilus lecontei Baird and Girard.
Elaps euryxanthus Kennicott.

Station No. 43.—Corner Monument No. 127, where the Boundary leaves the parallel 31° 20′, 482 kilometers (300 miles) west of the Rio Grande and 377 kilometers (234 miles) east of the Colorado River; altitude, 1,592 meters (5,223 feet). This station is in the midst of the Pajaritos Mountains, which rise from a base level of 1,100 meters (3,609 feet) to the altitude of 1,836 meters (5,924 feet). These rugged and little-known mountains have never received from zoologists and botanists the attention which their importance merits. I was absent in Texas when the detailed survey of them was made by the International Boundary Commission. Subsequently, when attached to the Monument-Building Party of the survey, they were but hastily examined from Stations 42 and 44. Their flora is said to be unusually varied, and the name, meaning "little birds" mountains, is justified by the abundance of small birds during the breeding season, which is doubtless due to the considerable number of watering places. (Plate XII, fig. 1.) To the north of these mountains, which extend from Monument No. 126 to Monument No. 142, is a low, open country, which was crossed in several directions by myself in going from Nogales to Tucson, from Tucson to Warsaw, and thence to La Osa by way of Oro Blanco, Arivaca, and Tres Bellotas (= 3 Emory oaks),[a] and, later, from La Osa to Tucson and back by way of Labaree, Pozo Bueno, and Buenos Ayres.

Station No. 44.—Tumacacori Mission, on the Santa Cruz River, Pima County, Arizona; altitude about 1,000 meters (3,281 feet).

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[a] In the canyons about Tres Bellotas some remarkably fine specimens of Emory oak (*Quercus emoryi*) were seen.

As the stream is broadly bordered by trees, and the adjacent country covered by mesquite and brushwood, this river valley is an ideal collecting ground. I was there October 28 and 29, 1893, and collected a few birds and mammals.

STATION No. 45.—Santa Cruz River, 25 miles south of Tucson, Arizona; altitude, 865 meters (2,838 feet). I collected specimens October 29 and 30, 1893.

STATION No. 46.—Tucson, Arizona; altitude, 736 meters (2,415 feet). No place in Arizona has as rich a fauna; and there is considerable variety to the flora. The Santa Cruz Valley is well wooded with cottonwood, willow, mesquite, and cultivated fruit trees. I collected there in April and May, 1885; also, October 30 to November 30 and December 11 to 12, 1893. Mr. Holzner was there from October 30 to November 5 and November 17 to 28, 1893.

Flora of Tucson, Arizona.—This fertile field has been well covered by visiting botanists and by Prof. James William Toumey, of the University of Arizona, at Tucson. The following list includes the common trees seen by me on my brief visits, when I was the recipient of many favors and polite attentions on the part of President Comstock and Professor Toumey, of the university, and of Mr. Herbert Brown, of Tucson, all of whom imparted much useful information respecting the local fauna and flora:

Yucca sp.
Yucca sp.
Salix nigra Marshall.
Salix occidentalis longipes (Andersson) Bebb.
Populus fremontii Watson.
Celtis occidentalis Linnæus.
Acacia greggii Gray.
Prosopis glandulosa Torrey.
Prosopis odorata Torrey and Fremont.
Parkinsonia microphylla Torrey.
Kœberlinia spinosa Zuccarini.
Melia azedarach umbraculifera Sargent.
Nicotiana glauca Graham.
Acer negundo Linnæus.
Cereus giganteus Engelmann.
Opuntia fulgida Engelmann.
Opuntia versicolor Coulter.
Opuntia spinosior (Engelmann) Toumey.
Fraxinus velutina Torrey.
Chilopsis linearis (Cavanilles) Sweet.
Sambucus glauca Nuttall.

The vegetation in the region about Tucson presents an extremely picturesque appearance. The streams—Rillito Creek and the Santa Cruz River—are well wooded with screw bean, mesquite, cottonwood, willow, boxelder, and ash, groups of which are often converted into fragrant bowers by climbing grape and *Philibertella*, with spiny asters, showy daturas, and many flowering annuals beneath and around them. The foothills of the Tucson and Santa Catalina mountains are sprinkled with the giant cactus. Going toward the Santa Catalinas, one emerges upon a plain sloping up to the intervening valley of Rillito Creek. The foreground is spread with prickly pear and the gregarious creosote bush, which, in season, is covered with yellow flowers. Patches of arborescent cacti cover much of the ground and bear red blooms as beautiful as roses. Mesquites begin as shrubs no larger than the mimosa and acacia on the sandy mésa, but increase to the dimensions of New England apple trees, the mesquite groves of the Rillito having a decidedly orchard-like appearance. On the hills across the stream the giant cactus holds sway, giving a fascinating effectiveness to the landscape at all times and a peculiar beauty when, in May, each of its huge arms unfolds a coronet of white flowers, in the midst of which white-winged doves delight to settle and coo. The green-barked palo verde with its tiny leaflets, the gold and purple flower balls attached to slender branches of acacia and mimosa, and the coral-red tips of bloom to the tall and wand-like stems of clustering ocotillo, give a needed coloring to these rough slopes, which require but the finishing touch of bristling bisnaga, serrate dasylirion, scarlet-flowered cereus and choya, and yellow nopal to complete a picture of strange beauty. When I visited Fort Lowell, in April, 1885, the officers' quarters were shaded and screened by a beautiful paling of living ocotillos (*Fouquieria splendens* Engelmann), which bloomed, and whose leaves were as freshly green as when growing naturally, although the stems were merely thrust into the ground and nailed to the porch above. This thorny plant is also called candlewood and corral-wood from its uses. The flowers, superficially, resemble those of the *Fuschsia.*

To Col. Bernard J. D. Irwin,[a] surgeon, U. S. Army, the science of herpetology is indebted for very large collections of the reptiles and batrachians of old Fort Buchanan, situated at the head of Sonoyta Creek, a tributary of the Santa Cruz, near Tucson, Arizona. These collections were made at the suggestion of Professor Baird, and are now in the United States National Museum. Since his time other species have been added to the national collection by Maj. W. H. Emory, Lieuts. F. T. Bryan and J. H. Rutter, of the Army; Arthur Schott, Edward W. Nelson, Pierre Louis Jouy, Louis John Xantus de Vesey, Henry W. Henshaw, Herbert Brown, F. X. Holzner, and the writer. The list of reptiles and batrachians known from the region of Tucson, Fort Buchanan, and Camp Lowell is therefore a long one, as follows:

Turtles.

Kinosternon sonoriense Le Conte.	*Terrapene* sp.[b]

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[a] More important than all Colonel Irwin's contributions of notes and specimens to the Smithsonian Institution was his early training of Charles Emil Bendire, the distinguished author of Life Histories of North American Birds, in exact methods of scientific observation. Bendire was then a young soldier of his command, attached to the hospital corps, and stationed at old Fort Buchanan and other camps in the vicinity of Fort Lowell and Tucson.

[b] The skin of a box-turtle, taken between Benson and Mountain Spring, Arizona, May 4, 1885, and prepared by the writer, is in the collection of the American Museum of Natural History, New York.

Lizards.

Crotaphytus wislizenii Baird and Girard.
Callisaurus draconoides ventralis (Hallowell).
Uma scoparia Cope.
Holbrookia maculata maculata Girard.
Uta stansburiana Baird and Girard.
Uta symmetrica Baird.
Sceloporus clarkii Baird and Girard.
Sceloporus undulatus consobrinus (Baird and Girard).
Phrynosoma douglassii hernandesi (Girard).
Phrynosoma douglassii ornatissimum (Girard).
Phrynosoma solare Gray.
Phrynosoma cornutum (Harlan).
Anota platyrhina (Girard).
Eublepharis variegatus (Baird).
Heloderma suspectum Cope.
Cnemidophorus tessellatus tessellatus (Say).
Cnemidophorus tessellatus melanostethus Cope.
Cnemidophorus sexlineatus (Linnaeus).
Cnemidophorus gularis gularis Baird and Girard.
Eumeces obsoletus (Baird and Girard).

Snakes.

Glauconia humilis (Baird and Girard).
Diadophis [*amabilis docilis* (Baird and Girard)?].
Zamenis lateralis lateralis (Hallowell).
Salvadora grahamiæ Baird and Girard.
Phyllorhynchus browni Stejneger.
Pityophis sayi bellona (Baird and Girard).
Ophibolus getulus splendidus (Baird and Girard).
Rhinochilus lecontei Baird and Girard.
Gyalopium canum Cope.
Chilomeniscus ephippicus Cope.[a]
Hypsiglena ochrorhyncha Cope.
Eutænia megalops Kennicott.
Eutænia elegans marciana (Baird and Girard).
Eutænia nigrilatus Brown.
Trimorphodon lyrophanes Cope.
Crotalus molossus Baird and Girard.
Crotalus adamanteus scutulatus (Kennicott).
Crotalus adamanteus atrox (Baird and Girard).
Crotalus confluentus confluentus Say.
Crotalus tigris Kennicott.
Crotalus cerastes Hallowell.

Batrachians.

Bufo sp.
Rana virescens brachycephala Cope.

Station No. 47.—Old Fort Lowell, Arizona. This abandoned military post, also known as Camp Lowell, is located on Rillito Creek, at the foothills of the Santa Catalina Mountains, 6 miles northeast of Tucson. The stream is clear and contains fishes. Its banks are beautifully wooded with cottonwood, willow, boxelder, elder, ash, and grape. A mesquite-and-cactus country borders it on the south and the foothills of the Santa Catalina Mountains on the north. The cacti are very characteristic of the country adjacent to the Santa Catalina Mountains. Besides the giant *Cereus* and the genera *Cactus*, *Echinocactus*, etc., there is a remarkable profusion of and variety in the genus *Opuntia*, of which *O. acathocarpa*, *O. arborescens*, *O. arbuscula*, *O. leptocaulis*, and *O. fulgida* are among the most conspicuous. This is a well known collecting ground of Messrs. Bendire, Henshaw, Nelson, F. Stephens, Brown, Scott, and Price. The writer also visited the place in April and May of 1885, and again in November, 1893. Mr. Holzner camped there from November 5 to 20, 1893, collecting 70 birds and 32 mammals.

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[a] Cope, in Proc. U. S. Nat. Mus., XII, p. 147, mentions a living specimen of *Chilomeniscus cinctus* Cope from Tucson, Arizona; but, as he does not refer to it in his Monograph of the Crocodilians, Lizards, and Snakes of North America, 1900, but speaks of specimens of *Chilomeniscus ephippicus* Cope from Tucson, it may be inferred that all were of the latter species.

STATION No. 48.—Warsaw Mills, Pima County, Arizona. This camp was located at springs in Holdens Canyon in the Pajaritos Mountains, about 2 kilometers (1.75 miles) north of Monument No. 132, 505 kilometers (314 miles) west of the Rio Grande, and 354 kilometers (220 miles) east of the Colorado River. Altitude, 1,220 meters (4,003 feet). I was there from December 1 to 7, 1893, and Mr. Holzner, from November 29 to December 7, 1893. For collecting, this camp was unfavorably located, in a barren and rocky canyon. The only timber was a scanty growth of glaucous-blue and Emory oak (*Quercus oblongifolia* and *Q. emoryi*). Birds and mammals were scarce in the vicinity, though numerous in more favorable localities in the neighborhood. Remunerative trips were made to Monument No. 127, and to Bear Valley, near Oro Blanco Picacho, at the head of Cañon de los Alisos, where a stream of fresh water, containing fish, and tributary to the Altar River, was shown us by Mr. C. W. Kempton, the manager of El Volador Mine, at Oro Blanco. Some of the nearer canyons were well wooded with cottonwood, oak, walnut, hackberry, and sycamore, but were too difficult of access to be visited often from our camp at Warsaw Mills.

Flora of Pajaritos Mountains.—The following-named trees were observed in the Pajaritos Mountains, between Monuments Nos. 122 and 140:

Pinus cembroides Engelmann.
Juniperus pachyphlœa Torrey.
Yucca brevifolia Torrey.
Yucca sp.
Juglans rupestris Engelmann.
Salix nigra Marshall.
Salix occidentalis longipes (Andersson) Bebb.
Salix taxifolia Humboldt, Bonpland, and Kunth.
Populus fremontii Watson.
Quercus oblongifolia Torrey.
Quercus arizonica Sargent.
Quercus toumeyi Sargent.
Quercus chrysolepis Liebmann.
Celtis occidentalis Linnaeus.
Morus celtidifolia Humboldt, Bonpland, and Kunth.
Platanus wrightii Watson.
Cercocarpus parvifolius paucidentatus Watson.
Prunus salicifolia Humboldt, Bonpland, and Kunth.
Acacia greggii Gray.
Prosopis glandulosa Torrey.
Parkinsonia aculeata Linnaeus.
Parkinsonia microphylla Torrey.
Robinia neomexicana Gray.
Ptelea trifoliata Linnaeus.
Sapindus marginatus Willdenow.
Cereus giganteus Engelmann.
Opuntia fulgida Engelmann.
Opuntia versicolor Engelmann.
Opuntia spinosior (Engelmann) Toumey.
Arctostaphylos pungens Humboldt, Bonpland, and Kunth.
Zizyphus obtusifolius Gray.
Fraxinus velutina Torrey.
Chilopsis linearis (Cavanilles) Sweet.
Sambucus mexicana Presl.
Nicotiana glauca Graham.

Other conspicuous plants are:

Ephedra trifurca Torrey, and other species.
Yucca baccata Torrey.
Dasylirion wheeleri Watson.
Agave sonoræ (Torrey) Mearns.
Amaranthus sp.
Rubus sp.
Kunzia tridentata (Pursh) Sprengel.
Mimosa. (Several species.)
Acacia. (Several species.)
Erythrina flabelliformis Kearney.
Fouquieria splendens Engelmann.
Rhus toxicodendron Linnæus.
Rhus trilobata Nuttall.
Ceanothus fendleri Gray.
Vitis arizonica Engelmann.
Parthenocissus quinquefolia (Linnæus) Planchon.
Cereus pectinatus rigidissimus Engelmann.
Opuntia. (Several species, of subgenera. *Platypuntia* and *Cylindropuntia.*)
Philabertella cynanchoides (Decaisne) Vail.
Datura meteloides de Candolle.
Stenolobium stans (Linnæus) D. Don.
Cucurbita digitata Gray.
Cucurbita fœtidissima Humboldt, Bonpland, and Kunth.
Lobelia splendens Willdenow.
Xanthium sp.
Baccharis. (Several species.)

Lieutenant Gaillard, who was in the Pajaritos Mountains during the flowering season of plants, in his Report (p. 2) observes:

> The mountains are covered with a fine growth of evergreen oak, juniper, and manzanita, while magnificent walnut, sycamore, and ash trees line the canyons. Excellent grass covers the hills; thousands of beautiful wild flowers spring up on all sides during the rainy season; game is abundant and the climate unsurpassed. From the highest part of these mountains the view is beautiful beyond description and stretches away for 75 or 100 miles in every direction. Throughout this entire region, probably one of the roughest and most cut up in North America, there are no roads and but a few blind trails. Little or no water is to be found during the dry season, except by digging, although there is evidently a considerable underground drainage, as the Altar River, Arivaca Creek, and Nogales Creek, all permanent streams, derive their waters from the drainage of these mountains, which were notable, not only on account of their beauty, but also because they constituted the last timber-covered mountains encountered on the survey until the Coast Range was reached, and because in them was seen for the first time the strange and ungainly giant cactus (*Cereus giganteus*), called "suguaro" by the Mexicans.

STATION NO. 49.—Arivaca Creek, Pima County, Arizona. This station is 18 kilometers (11 miles) north of Monument No. 135; 532 kilometers (331 miles) west of the Rio Grande, and 327 kilometers (203 miles) east of the Colorado River; altitude about 1,000 meters (3,281 feet). This is a wooded stream bordered by a broad plain on the north and near the foothills of the Pajaritos Mountains on the south. The present writer was there during December 8 and 9, 1893, and Mr. Holzner December 7, 1893.

STATION NO. 50.—La Osa, Pima County, Arizona. The camp was one-half mile north of Monument No. 140, 534 kilometers (332 miles) west of the Rio Grande, and 325 kilometers (202 miles) east of the Colorado River. Altitude, 1,100 meters (3,609 feet). This station is at the western extremity of the Pajaritos Mountains. We camped close to the ranch house of Mr. W. S. Sturges. The only water anywhere near is the well (Pozo Verde) of the Papago Indians, west of the Pozo Verde Mountains, and a large lake (not permanent) at Buenos Ayres, 6 miles distant. Most of our specimens came from a dry water course running from our camp to join the Altar River in Sonora. Though there is comparatively little wood in the surrounding hills and plains, this wash was well wooded with fine hackberries, mesquites, and a few oaks (*Quercus emoryi* and *Q. oblongifolia*), which latter were the last oaks seen until the Coast Range Mountains of California were reached. This ravine also contained a good deal of underbrush. The neighboring Pozo Verde Mountains, on the west, are barren and rocky. They reach the altitude of 1,419 meters (4,656 feet). Besides mesquite, there grew upon them ocotillo, giant cereus, palo verde, and some bushes and smaller cacti. I was at this station from December 9 to 10 and 14 to 28, 1893, and Mr. Holzner from December 8 to 28, 1893. Large collections of vertebrates were made. Few plants were obtainable at that season. A molar tooth of a fossil elephant was obtained by the Papagos at the Pozo Verde and presented to us by Mrs. W. S. Sturges.

Fauna of Pajaritos Mountains.—This region was only seen by us in winter, when the most interesting and characteristic animals were hibernating and not easy to find. The reptilian fauna includes, besides those mentioned as having been collected at Nogales, two poisonous snakes, *Elaps euryxanthus* Kennicott and *Crotalus tigris* Kennicott, and an abundance of the small box turtle (*Terrapene*), appearing after rains. Of batrachians, a toad (*Bufo*) and a frog (*Rana virescens brachycephala* Cope) were found at Warsaw Mills; and at Buenos Ayres, at the beginning of the summer rains, Lieutenant Gaillard observed great numbers of a very large frog-like toad, named *Bufo alvarius* by Girard. Nothing was seen or heard of them until the advent of the early summer rains, which formed a large shallow lake near Buenos Ayres and about 10 kilometers (6 miles) north of the Boundary Line. These large toads then filled the air with their loud cries, which increased until a deafening roar was produced. Numbers of them were seen hopping about, but their rarity was not suspected by Lieutenant Gaillard, on which account none were collected. The range of *Bufo alvarius* Girard, extends from Monument No. 73, in Guadalupe Canyon, to the Colorado River (Monument No. 205). I first met with it in a dense growth of arrowwood (*Pluchea sericea*) on the edge of the Colorado River at Fort Mojave, Arizona, May 13, 1884. A specimen was carried to Peach Springs and given into the charge of the hotel proprietor, who allowed it to escape during my absence at the Grand Canyon of the Colorado. No specimen of this toad was again seen until July 6.

1892, when Lieutenants Gaillard and Irwin and the writer lay down to rest upon the damp grass beside the San Bernadino Springs, near Monument No. 77. At dusk these huge green batrachians began to hop about us, occasionally landing upon our faces. A few were caught and saved as specimens. No more were seen by me until October 3, 1893, when Hospital Steward E. C. Merton brought me another that he had just caught at a spring situated between Monument No. 73 and Cajon Bonito Creek, in Sonora, Mexico. Another was taken at Quitobaquita Springs, Monument No. 172, January 26, 1894.

Station No. 51.—La Ventana Ranch, Pima County, Arizona. This place is about 9 kilometers (5.5 miles) from Monument No. 146, 573 kilometers (356 miles) west of the Rio Grande, and 286 kilometers (286 miles) east of the Colorado River. Altitude, 675 meters (2,215 feet). The region west of the Pozo Verde Mountains is a vast plain, dry, but otherwise fertile, declining to the level of the Gulf of California and Colorado River. This extensive area is strewn with desert ranges of mountains, trending from northwest to southeast. Monument No. 146, on the Moreno Mountain (altitude, 1,420 meters), marks the western border of the Moreno Flat, which is bounded on the east by the Baboquivari and Pozo Verde Mountains. This flat is covered with grass and shrubbery, and is rich in animal and plant life. In it we found groves of the long-leaved palo verde (*Parkinsonia aculeata* Linnæus). In traveling from La Osa to La Ventana we found the first skeletons of the large land turtle, *Gopherus agassizii* (Cooper), whose range extends to the Colorado River.

Station No. 52.—Pozo de Luis, or el Vanorí, Sonora, Mexico. Station 8 kilometers (5 miles) south of Monument No. 152, 595 kilometers (370 miles) west of the Rio Grande and 264 kilometers (164 miles) east of the Colorado River. Altitude, 700 meters (2,300 feet). Camp was made at the Indian village, by the well of Yaqui Luis, at the end of a valley at the west side of the Cobota Mountains, which latter are 1,060 meters (3,478 feet) in altitude. The rock is granite, uralite-diabase, rhyolite, and basalt. The Indians are mostly Papagos, though there are a few Yaquis, among them Luis, the owner of the well. There is no cultivated land beyond a patch of an acre or two beside and watered from the well. To the southwest is a plain that rapidly declines to the coast level at the Gulf of California. There was no bare ground in the neighborhood of this station, the whole region being covered with shrubs and cacti, with trees along the arroyos. Ironwood, mesquite, two species of palo verde, and tall acacias formed a heavy growth along the principal arroyos. Creosote bushes and cacti cover the higher flats, and the giant cereus and ocotillo are abundant on the hills and mountains. (Plate XII, fig. 2.) On the southern slopes of the Cobota Mountains we met with the first of the pitaya cactus (*Cereus thurberi*), which to the westward become a conspicuous feature. Large game was abundant in these mountains. General collections of unusual interest were made here by Mr. Holzner and the author from December 29, 1893, to January 8, 1894. The winter season was unfavorable for collecting reptiles, *Uta stansburiana* being, as usual, the only lizard common at that time of the year.

Flora of Pozo de Luis.—The trees are:

Salix nigra Marshall.
Populus fremontii Watson.
Acacia greggii Gray.
Prosopis glandulosa Torrey.
Parkinsonia microphylla Torrey.
Cercidium torreyanum (Watson) Sargent.
Olneya tesota Gray.
Opuntia fulgida Engelmann.
Opuntia versicolor Engelmann.
Opuntia spinosior (Engelmann) Toumey.
Cereus giganteus Engelmann.
Cereus thurberi Engelmann.

Other conspicuous plants are of the genera *Ephedra*, *Yucca*, *Dasylirion*, *Agave*, *Amaranthus*, *Atriplex*, *Fouquieria*, *Covillea*, *Simmondsia*, *Rhus*, *Zizyphus*, *Cactus*, *Echinocereus*, *Echinocactus*, *Opuntia*, *Datura*, *Bouvardia*, *Cucurbita*, *Xanthium*, and *Baccharis* (several species, including *B. emoryi*).

Station No. 53.—Nariz Temporal, Sonora, Mexico. Station about 10.5 kilometers (6.5 miles) south of Monument No. 159, 626 kilometers (389 miles) west of the Rio Grande, and 233 kilometers (145 miles) east of the Colorado River. Altitude, 500 meters (1,640 feet). Our camp was at the south end of the Nariz Mountains, beside a pool of surface water, at the western border of the Great Plain, which stretches between the Cobota and Nariz mountains. Much of the Great Plain, which is from 100 to 200 feet lower on the west than on the east side, is covered with grass, though shrubs and cacti cover large portions of it. The Nariz Mountains are very rocky, but support considerable undergrowth, especially near the base, which is also wooded with pitaya cactus, Sonoran ironwood (*Olneya tesota*), palo verde, and acacia. Along the laguna at the foot of the Nariz Mountains is a heavy growth of mesquite, about 15 feet in height. A very superficial examination of this interesting locality was made by Mr. Holzner and myself on January 8 and 9, 1894, when a few specimens were collected. Major Emory had taken the horned toad (*Anota modesta* Girard) at this place.

Station No. 54.—Santa Rosa Valley, at Monument No. 161, 632 kilometers (393 miles) west of the Rio Grande, and 343 kilometers (141 miles) east of the Colorado River. Altitude, 516 meters (1,693 feet). Visited by myself and Mr. Holzner January 9, 1894.

Station No. 55.—Sonoyta, Sonora, Mexico. The camp was at the edge of a mesquite flat beside the Sonoyta River, about 3 kilometers (2 miles) south of Monument No. 168, which is 661 kilometers

(411 miles) west of the Rio Grande and 198 kilometers (123 miles) east of the Colorado River. Altitude, 400 meters (1,312 feet). The Mexican town of Sonoyta, beside which our camp was located, is near the head of the Sonoyta River, a pretty creek containing several species of fish, which rises south of Monument No. 164 and flows west to Quitobaquita, where it almost touches the International Boundary Line, and thence southwest to the Gulf of California. Some months prior to our arrival, during a period of unusual rainfall the river had washed away its banks in such a manner as to destroy the then existing system of irrigation entirely and to prevent its reconstruction. At the time of our visit only a few fields on the right (north) side of the Sonoyta River were under irrigation, and these received their water from springs at some distance from the river. Trapping would have yielded better results for our mammal collection had we been there during the period of agricultural prosperity.

Below the village of Sonoyta is a settlement of Papago Indians, who successfully irrigate large fields from the Sonoyta River. The ground had been well plowed with the ingenious wooden plows made by the Indians.

A few miles farther down the stream is the Mexican town of Santo Domingo, distant about 14.5 kilometers (9 miles) from Sonoyta. The freshet, which had been calamitous to the people of Sonoyta, had greatly benefited the residents of Santo Domingo by turning all of the water of the Sonoyta River into their irrigation canal.

These settlements of the Sonoyta Valley are surrounded by low mountains and hills—the Sierra de Sonoyta. The highest peaks (altitude, 1,348 meters, or 4,423 feet) are about 15 kilometers (9 miles) south of the Boundary, while those to the north of it, in the vicinity of our station, are from 600 to 900 meters (1,000 to 1,450 feet) in altitude. They are covered with a growth of shrubbery and cactus, so that open, grassy stretches of country are no longer visible to the eye, when viewing the country from an elevation, as they are in the region east of the Baboquivari Mountains. The bushy or chaparral country begins about 16 kilometers (10 miles) east of Pozo de Luis (Station No. 52 south of Monument No. 152) and extends west to La Represo (Monument No. 179). From the latter point to the Coast Range of mountains, near the Pacific coast, lies the most barren desert of America.

Desert vegetation is abundant around Sonoyta. Fig trees thrive in a half-wild state, cottonwoods and willows border the fields and acequias, and a luxuriant thicket of young mesquite edges the Sonoyta, where it has not been dug away to make place for fields and gardens. On the hills the giant cereus and pitaya are the most marked features of the arboreal vegetation, the latter preferring the rocky heights; but the screw-bean, palo verde, acacia, ironwood, and elder are abundant in the valleys. The smoother tracts are covered by the choya, tasajo, and other cacti, mixed with sagebrush, greasewood, creosote bush, ocotillo, and *Ephedra*. Along the river are patches of gourds, *Baccharis*, arrowwood, canes and tule.

The writer, assisted by Mr. Holzner, collected energetically at this station from January 9 to 25, 1894, and brought together a fine collection of mammals, birds, and fishes; but plants and reptiles were scarce at that season. A frog was taken from the stomach of a chaparral cock; mud turtles (*Kinosternon sonoriense* Le Conte) were numerous in springs and in the Sonoyta River; one snake was obtained at Santo Domingo; and a lizard (*Uta stansburiana* Baird and Girard) was found in some numbers. Reptiles were reported to have been very numerous in the Sonoyta Valley in warm weather. Lieutenant Gaillard speaks of the horned rattlesnakes, or "side winders," which he killed between Gila Bend and Sonoyta as having seemed to him different from those on the deserts bordering on the Colorado River. The latter were *Crotalus cerastes* Hallowell.

STATION No. 56.—Santo Domingo, Sonora, Mexico. Station 2 kilometers (1.5 miles) south of Monument No. 170, 670 kilometers (417 miles) west of the Rio Grande, and 189 kilometers (117 miles) east of the Colorado River. Altitude, 360 meters (1,181 feet). Frequent visits were made to this locality in January and February, 1894, by myself and Mr. Holzner.

STATION No. 57.—Quitobaquita, at Monument No. 172, 678 kilometers (421 miles) west of the Rio Grande and 181 kilometers (113 miles) east of the Colorado River. Altitude, 320 meters (1,050 feet). The Quitobaquita Springs, at which our camp was made, are close to the International Line, in Pima County, Arizona, at the foot of the Sierra de Quitobaquita, whose altitude is 845 meters (2,772 feet). The region is more barren than that around Sonoyta and Santo Domingo. The La Abra Plain, on the east, is covered with coarse chaparral; but the lower course of the Sonoyta River is through a more open and sandy region, the soil being sandy loam and coarse gravel, with the low places incrusted with alkali. The rock is granite, rhyolite, and basalt.

Passing down the Sonoyta Valley from the town of Sonoyta, the valley broadens at Santo Domingo into an extensive bottom, which is largely under irrigation and cultivation. A small garden at Quitobaquita is irrigated from springs emerging from a hillside on the right (north) bank of the Sonoyta River and 1 mile from it, at a point 8 kilometers (5 miles) below Santo Domingo. The Sonoyta Valley is a little more than a mile in width at this part between low mountains of coarse granite rock. It is partly covered by patches of creosote bushes, shrubbery, and cacti. The giant cereus is common and there are many pitayas on the rocky hills. The choya forms groves, in which the largest plants are sometimes from 2 to 4 meters in height, and gaunt at that season (January and February) from the annual shedding of their joints. The sandy arroyos contain patches of *Parosela spinosa*, and are bordered by ironwood, large and small-leaved palo verde and mesquite trees.

The settlement consisted of three adobe dwellings, a warehouse, and a corral at the springs, and a small house at the garden. From Quitobaquita Springs several streams flow into a shallow, artificial lake, the overflow from which is conducted by an acequia to an extensive field of wheat and white clover, bordered by fig trees and surrounded by a brush fence. This proved to be an excellent collecting ground for birds and mammals. A few ducks and waders and one pair each of the white-bellied swallow, black phœbe, and vermilion flycatcher frequented the lake. *Dipsosaurus dorsalis* and *Uta stansburiana* were common lizards. A toad (*Bufo alvarius* Girard) was also taken.

This station was occupied by the writer and Mr. Holzner from January 25 to February 8, 1894.

Flora of Sonoyta Valley (Monuments Nos. 164 to 174).—Trees:

Salix nigra Marshall.
Populus fremontii Watson.
Acacia greggii Gray.
Prosopis odorata Torrey and Fremont.
Prosopis glandulosa Torrey.
Parkinsonia aculeata Linnæus.
Parkinsonia microphylla Torrey.
Cercidium torreyanum (Watson) Sargent.
Parosela spinosa (Gray) Heller.
Olneya tesota Gray.
Cereus giganteus Engelmann.
Cereus thurberi Engelmann.
Opuntia fulgida Engelmann.
Opuntia versicolor Engelmann.
Opuntia spinosior (Engelmann) Toumey.
Sambucus glauca Nuttall.

Zizyphus obtusifolia Gray.—This species (specimen No. 2739, orig. 198) becomes a small tree, having a trunk from 1 to 4 decimeters in diameter and a height of 3 to 6 meters, and with branches all armed with very long spines. It usually branches from the ground, around the main trunks, spreading so as to form an impenetrable growth. It is common in valleys.

Conspicuous plants, other than trees, are:

Scirpus olneyi Gray.
Scirpus occidentalis (Watson) Chase.
Fouquieria splendens Engelmann.
Covillea tridentata (de Candolle) Vail.[a]
Euphorbia misera Gray.
Echinocactus wislizeni Engelmann.
Echinocactus wislizeni lecontei Engelmann.
Datura meteloides de Candolle.
Anemopsis californica (Nuttall) Hooker and Arnott.
Aster spinosus Bentham.
Baccharis emoryi Gray.
Baccharis glutinosa Persoon. (Mexican name, "batamote.")
Pluchea sericea (Nuttall). (Mexican name, "cochinilla.")

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[a] The creosote bush is called by the Mexicans "gobernadora" or "hediondilla," and is much used as a remedy for rheumatism in man and (asthma?) in horses.

Species of the following genera also occur: *Typha*, *Ephedra*, *Phoradendron* (red-berried, on nearly all the trees, but thriving especially upon the mesquite), *Atriplex*, *Amaranthus*, *Cactus*, *Echinocereus*, *Echinocactus*, *Opuntia*, *Lycium* (called "cuanvir" by Mexicans), *Cucurbita* (palmate-leaved), *Xanthium* (called "cadillo" by Mexicans), *Trixis* (a woody species), and *Artemisia*. Other plants not identified by specimens were called "chamizo," "rama amarilla," "chicura" (a coarse composite), and "yerba de la flecha" (a small, bushy tree, in canyons and arroyos, from Nariz Mountain to La Represo; has a double-seeded fruit, and in February red leaves; said to be very poisonous if taken as a decoction).

Station No. 58.—Rancho de Agua Dulce, Sonoyta River, Sonora, Mexico. This place is about 6.4 kilometers (4 miles) southwest of Monument No. 173, 690 kilometers (429 miles) west of the Rio Grande, and 169 kilometers (105 miles) east of the Colorado River. Altitude, 280 meters (919 feet). The writer made several visits to this place in January and February, 1894, collecting plants, birds, and mammals. Lagunas of the Sonoyta River between Agua Dulce and Cerro Blanco are the resort of many aquatic birds. The rock is coarse granite, rhyolite, and basalt. Spherulitic nodules are abundant in obsidian flows, which, alternating with sheets of rhyolite, form a high bluff on the right bank of the Sonoyta at Agua Dulce.

When the surveying party was working in this vicinity during the month of June, 1893, the heat was intense, the maximum temperature in the shade reaching 118° F. The standard thermometer used was not graduated sufficiently high to give the temperature in the sun after 8 or 9 o'clock a. m., at which time it ranged from 130° to 140° F., the temperature in the shade at the same time ranging from 95° to 105° F., a ratio which would seem to indicate an average maximum sunshine temperature during June of about 150° F. The temperature during June, 1893, must be considered, however, as in excess of the average, for a themometer record kept at Sonoyta and covering a period of several years showed this to have been the hottest June during the period covered by the observations. (D. D. Gaillard in Report of International Boundary Commission, p. 23.)

Station No. 59.—La Represo, at Monument No. 179, 715 kilometers (444 miles) west of the Rio Grande, and 144 kilometers (90 miles) east of the Colorado River. Altitude, 210 meters (689 feet). This camp is in the eastern part of the Tule Desert. A small collection was made by the author and Mr. Holzner February 8 and 9, 1894.

Vegetation.—In traveling from the Sonoyta River at Agua Dulce to La Represo we crossed, about midway, a broad forest of the sinita (*Cereus schottii* Engelmann), one of the largest and most singular of the cacti, which we never saw elsewhere. It occupied a *mal pais* region, covered with scoriaceous basalt. This forest of giant cacti stretched away as far as the eye could reach into Arizona and Sonora. We ascertained that the range of the largest North American cactus, *Cereus pringlei* Watson, extends to within a few miles of the Boundary near this point, but nowhere crosses the International Line. Other trees seen on this journey were the small-leaf horse bean, whose habitat is quite general, that of the true palo verde (*Cercidium torreyanum*) being restricted to the edges of arroyos. The Sonoran ironwood was quite generally distributed and unusually large. The indigo thorn (*Parosela spinosa*), locally called mangle, was abundant all along the Sonoyta, but did not appear again until the Tule Mountains were reached. Mesquites were occasionally seen, and on them the red-berried mistletoe grew, as it did upon all of the trees mentioned, excepting the mangle and cacti. Ocotillo, yerba de la flecha, pitaya, and bisnaga were abundant.

Station No. 60.—Camel Skeleton, a mile north of Monument No. 181, 729 kilometers (453 miles) west of the Rio Grande, and 130 kilometers (81 miles) east of the Colorado River. Altitude, 245 meters (804 feet). Small collections were made at this camp, in the midst of the Tule Desert, February 9 and 10, 1894.

Station No. 61.—Tule Wells, Yuma County, Arizona, about 6 kilometers (3¾ miles) northeast of Monument No. 186, 763 kilometers (474 miles) west of the Rio Grande, and 96 kilometers (60 miles) east of the Colorado River. Altitude, 375 meters (1,230 feet). There are two ordinary wells at this place, which is in the midst of a wild and rugged desert range called the Tule Mountains, though there are no signs of tules or other aquatic vegetation in the region, and no water on the surface of the ground. The mountains reach an altitude of 756 meters (2,480 feet), and are rocky and barren, the rock consisting of granite, quartz, hornblende-mica-andesite, and basalt. Cacti (*Cactus*, *Echinocactus*, *Cereus*, and *Opuntia*), an *Agave*, and a few stunted palo verde and ironwood trees grow on their rocky sides, and in some of the canyons an enormous nolina, with a tall caudex, which is sometimes a meter or more in diameter, grows sparingly. Along the arroyos a dusty-looking, spiny tree, *Parosela spinosa* is abundant, the largest individuals reaching the height of 8 meters. Mesquites and large-leaved palo verde, ironwood, asclepias, creosote bush, and sagebrush are found about the base of the mountains and along dry water courses. There is water in a few places in the mountains, in tanks which are small and hard to find. Plants and animals were collected from February 9 to 14, 1894, by myself and assistant.

Flora of Tule and Granite Mountains.—No large collections were made in the vicinity of this station. So barren are these desolate ranges that the occurrence of an arborescent nolina (*Nolina bigelovii* Watson), having a caudex and flowerstalk together measuring 7 meters in height, was a surprise. An agave, in a new form, reappeared for the first time since leaving the Lesna and Cobota mountains. This agave was only seen in the Tule Mountains of Arizona and Sonora. The plant is about the size of *Agave lechuguilla* Torrey, with something of the appearance of *Agave applanata parryi* (Engelmann) Mulford. The broad leaves have fleshy margins and remarkably stout, deflected spines, which spring from the margins of the leaf, which is similar to that of *parryi* in shape, glaucous, and armed with an indurated terminal spine about 25 mm. in length. The flower-stalk is 1 to 3 meters in height and resembles that of *Agave applanata parryi*. It was not seen in flower. Mesquites here grow to a considerable size, in canyons, and develope a spreading habit of growth, the branches forming elbows which reach the ground and are often buried in the sand, the extremities again ascending. The palo verde is uncommon; but the small-leaf horse bean is abundant, growing up the mountain slopes and canyons, as well as on arroyos, though sparingly in the hills. The Sonoran ironwood ascends to the mountain tops. In the bed of a sandy arroyo the indigo thorn, in one instance, became a tree one-third meter (1 foot) in diameter and 7.3 meters (24 feet) in height. *Echinocactus wislizeni*, which was not seen west of the Sonoyta, was here replaced by *Echinocactus lecontei*, which was not seen east of Quitobaquita, where both occurred. A cactus was first found here, growing in the form of a mound, like a pyramid of cannon balls, each as large as a coconut. It occupied smooth slopes of bare ground, covered with small chips of volcanic rock. There were other new forms of cacti, among them a coarse *Cylindropuntia* having whitish spines; this first appeared in the Sierra de la Salada, and, in the desert ranges to the westward, became the prevailing cactus and the chief food plant of the mountain sheep. A very singular plant is *Terebinthus microphylla* (Gray) Rose (*Bursera microphylla* Gray), which has the appearance of a stout, woody shrub, but is so soft and spongy that when a plant dies it melts down like a cactus and goes to pieces instead of drying hard in its natural form.

Reptiles.—It was said by several members of the surveying party that gila monsters of a kind different from those at San Bernardino, Monument No. 77 (*Heloderma suspectum* Cope), were numerous in the Tule and Tinajas mountains, which were surveyed in April and May. At the time of our visit (February) the only reptile much in evidence was the *Uta stansburiana*, which is often active when the temperature is quite low; but Mr. Joe H. Wheeler, who was the most accurate observer of the civilian employees of the survey, wrote me, in April, 1893, that he found:

> Lizards, very large, 18 to 24 inches in length; backs of a brick-red color; legs and head black; tail gray or granite color, and not very tapering; belly and breast reddish, and gray tinted on sides.

This description points to the chuck-walla (*Sauromalus ater* Duméril), as the alleged gila monster of this region.

In April, 1893, Mr. Wheeler found, in the Tule Mountains, a few horned toads and also snakes resembling the coach-whip, which were yellowish with dark stripes across the body and about 4 to 6 feet. He also found rattlesnakes (*Crotalus tigris* Kennicott) averaging 18 to 24 inches in length, light brown in color, with *stripes across* the body, and three to eight rattles. The head was rather large in proportion.

Station No. 62.—Range of Granite Mountains, about 6 kilometers (3½ miles) north of Monument No. 187, 766 kilometers (476 miles) west of the Rio Grande, and 93 kilometers (58 miles) east of the Colorado River; altitude about 325 meters (1,060 feet). The writer, who discovered a small tank of water in a canyon of these mountains, trapped mammals and collected birds and plants February 10 and 12 to 14, 1894.

Station No. 63.—Tinajas Altas, Yuma County, Arizona, 8 kilometers (5 miles) north of Monument No. 191; 789 kilometers (490 miles) west of the Rio Grande, and 70 kilometers (44 miles) east of the Colorado River. Altitude, 335 meters (1,099 feet). This important station is at the east base of the Gila Mountains, beside the lowest of a chain of natural rock tanks, in a steep ravine, containing an unfailing and almost inexhaustible supply of good water. (Plate XIII, fig. 1.) The upper tanks are easily overlooked and difficult of access, which facts afford the most plausible explanation of the loss of the lives of many persons whose bones and graves were thickly scattered about our camp. The Gila Mountains reach the altitude of 861 meters (2,825 feet), and are remarkably rocky, with crests so sharp that it is impossible to walk along their summits. The rock is a coarse granite. Around the base of these mountains the last of the giant cereus were found, on the Boundary Line. One species of palo verde, the small-leaf horse bean, and the ironwood, indigo, thorn, acacia, mesquite, and nolina complete the list of trees, which are mostly confined to arroyos around the base of the mountains. Species of *Lotus*, *Agave*, *Cotyledon*, *Fouquieria*, *Covillea*, *Ephedra*, *Datura*, *Nicotiana*, *Terebinthus*, *Cucurbita*, *Euphorbia*, and *Physalis* were common. Of cacti, a species of *Cylindropuntia*, called "tasajo," and another resembling the choya, one small species of *Platopuntia* that we only saw on the mountains of the Western Desert, a small, long-spined *Cereus*, the handsome, red-spined *Echinocactus lecontei*, and several species of the genus *Cactus* were the common sorts. *Cereus greggii* and one or two other cacti were found more sparingly. Collections in botany and zoology were made by the writer and his assistant from February 14 to 23, 1894, during which time a line of mammal traps were carried from the middle of the Lechuguilla Desert on the east to the summit of the Gila Mountains.

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1. Tinajas Altas, Western Desert Tract (See Page 122).
2. Campo, California, Pacific Coast Tract (See Page 135).

Reptiles.—In February, 1894, we observed but few species of lizards here, among them *Uta stansburiana* Baird and Girard, *Sceloporus clarkii* Baird and Girard, and a horned toad (specimen No. 41) that assumed two very different phases of coloration—gray on the granite débris around the base of the mountains and red on the Lechuguilla Desert east of the mountains, where the soil was red. Corresponding colorations were observed in the jack rabbits of this region. By pulling hard the men extracted from the crevice of a rock the tail of a huge lizard called the chuck-walla (*Sauromalus ater* Duméril), respecting which Mr. Joe H. Wheeler wrote in April, 1893, from this place as follows:

> Lizards very large, 12 to 16 inches in length; with black heads and legs and dirty or brick-colored backs and bellies; tail of a dusty gray; seen on highest peaks of the Tinajas Mountains.

Mr. Wheeler also noted dichromatism in the horned toad and the occurrence of the tiger rattlesnake (*Crotalus tigris* Kennicott) in these mountains.

Lieutenant Gaillard thus describes and figures one of two snakes taken between the ranges of the Gila Mountains in April, 1893: "I saw one in alcohol. It is about 6 inches long, and smaller around than a lead pencil. It is colored thus $(\overset{A}{\|}\quad\overset{B}{\circ}\quad\overset{A}{\|}\quad\overset{B}{\circ}\quad\overset{A}{\|})$: A, A, jet black bands entirely around the snake; B, B, splotches of red, with pink edges." This was probably an individual of *Chilomeniscus cinctus* Cope, in which the natural coloring had not yet faded in alcohol. I remember this species as appearing quite red in life.

STATION No. 64.—Yuma Desert, Monument No. 200, 835 kilometers (519 miles) west of the Rio Grande and 24 kilometers (15 miles) east of the Colorado River. Altitude, 45 meters (148 feet). This is the most barren desert on the Mexican Line, though there is more animal life upon it than was supposed by the members of Major Emory's surveying party. Only four species of plants—sagebrush, creosote bush, ephedra, and a coarse grass—were discovered on the middle portion of the Yuma Desert, although tender annuals doubtless spring up after rains and soon disappear. The only birds seen were a pair of ravens, which were feeding at deserted camps of the Monument-Building Party. Of mammals, a large species of kangaroo rat, a long-eared fox, a jack rabbit, and a small ground squirrel were quite common. At Monument No. 200, two beetles (*Eleodes grandicollis* and *E. acuticauda*), a desert cricket (*Stenopalmatus talpa*), a solpugid (*Datames californicus*), and a scorpion (*Hadrurus hirsutus* Wood) were collected by myself. I camped there from March 15 to 16, 1894. Lizards were abundant, and the following were collected:

Dipsosaurus dorsalis (Baird and Girard); *Crotaphytus wislizenii* Baird and Girard; *Callisaurus draconoides ventralis* (Hallowell); *Uma rufopunctata* Cope.

Of snakes, several individuals of *Chilomeniscus cinctus* Cope, and a great many of *Crotalus cerastes* Hallowell, were seen, and a specimen of each taken.

Station No. 65.—Gila River at Adonde Siding, on the Southern Pacific Railroad. This station, on the lower Gila, is about 37 kilometers (23 miles) north of Monument No. 195. Altitude, 60 meters (197 feet). The Gila Valley is wide at this part. Where the foothills approach the valley a few giant cacti were seen. The bottomland and adjacent arroyos support a growth of arrowwood, *Baccharis*, stramonium, cocklebur, and coarse sedges and rushes along the sloughs. The trees are cottonwood and willow beside the Gila, with ironwood, large-leaved palo verde, mesquite, screw-bean, acacia, and *Parosela spinosa* farther back. The mesquites are loaded with mistletoe. The loose soil of the Gila river bottom is covered with a plant having fleshy leaves, which ranges along the Gila and Colorado rivers to the Gulf of California. *Uta stansburiana* of Baird and Girard was common, and the only lizard taken; and *Kinosternon sonoriense* of Le Conte was the only turtle. I made collections at this station from February 14 to 23, 1894.

Station No. 66.—Gila River at Gila City, Yuma County, Arizona. Station 40 kilometers (25 miles) north of Monument No. 199. Altitude, 50 meters (160 feet). At this point the Gila Mountains close in upon the Gila Valley. The stream, as usual, is bordered by cottonwood and willow trees. Mesquite and screw bean are the common trees of the river bottom; ironwood, acacia (*A. greggii*), *Ephedra*, large-leaved palo verde, ocotillo, and the giant cactus occupy the foothills and arroyos; and smaller cacti and shrubs occur on the mountains. Along the Gila River are numerous sloughs, bordered with cat-tail, tule, cane, sedge, and rush. One species of gourd had a tuberous root, measuring one-third by one meter. Interesting collections of plants, fishes, birds, and mammals were made from March 1 to 5, 1894, by the writer and Mr. Holzner.

Flora of lower Gila River.—Between Adonde and Yuma the material collected is indicated in the lists that follow.

The trees are:

Salix nigra Marshall.
Salix fluviatilis Nuttall.
Populus fremontii Watson.
Acacia greggii Gray.
Prosopis odorata Torrey and Fremont.
Prosopis glandulosa Torrey.
Cercidium torreyanum (Watson) Sargent.
Parosela spinosa (Gray) Heller.
Olneya tesota Gray.
Cereus giganteus Engelmann.
Sambucus glauca Nuttall.

Other coarse plants are of the genera *Ephedra*, *Typha*, *Phoradendron*, *Atriplex*, *Amaranthus*, *Opuntia* (subgenera *Platopuntia* and

Cylindropuntia), *Nicotiana*, *Xanthium*, and *Baccharis* (several species), besides the following:

Scirpus occidentalis (Watson) Chase.
Scirpus olneyi Gray.
Covillea tridentata (de Candolle) Vail.[a]
Fouquieria splendens Engelmann.
Echinocactus lecontei Engelmann.
Philibertella cynanchoides (Decaisne) Vail.
Datura meteloides de Candolle.
Cucurbita palmata Watson.
Aster spinosus Bentham.
Pluchea sericea (Nuttall) Coville.

No species of *Agave*, *Yucca*, *Nolina*, or *Dasyliron* was found here or to the westward until the Coast Range was reached.

Reptiles.—At Gila City we obtained a beautiful snake, *Ophibolus getulus boylii* (Baird and Girard), a mud turtle, *Kinosternon sonoriense* Le Conte, and three species of lizards: *Crotaphytus wislizenii* Baird and Girard, *Uta symmetrica* Baird, and *Uta graciosa* (Hallowell).

A few frogs (*Rana*) were seen, and fishes were abundant in the Gila River.

STATION NO. 67.—Yuma, Arizona. This station is on the left (east) bank of the Colorado River, at the mouth of the Gila. The channels of the Gila and Colorado rivers are marked by lines of tall cottonwoods and a lesser fringe of willows. The adjacent bottom lands, which are broad and subject to annual overflow from the river, are more or less covered with mistletoe-matted mesquites and screwbeans. There are but few cacti, and these only in the hilly country in the vicinity of Yuma, where the creosote bush and desert willow also grow. There are a few tall Mexican elders where the soil is alluvial; but the commonest shrubs of the low ground are the arrowwood and *Baccharis*. As a result of an investigation along the Colorado River, made in January, 1902, by the hydrographic branch of the U. S. Geological Survey, the extent of the alluvial bottom land between Camp Mohave and Yuma was found to be from 400,000 to 500,000 acres. The alluvial deposits extend in a widening band along the Colorado from Yuma to the Mexican Gulf of California, forming a tropical tract which possesses distinctive biologic features. Although the rainfall at Yuma is but 3.06 inches a year, this tract is irrigable, and, like the Nile Valley, subject to annual overflowing. These high waters are rich in fertilizing sediments, are exceptionally free from alkaline salts, and come at an opportune time for irrigation. At the time of our visit a Norwegian engineer was engaged in surveying the lower portion of this tract with a view to reclaiming and utilizing it for agricultural purposes. I was here from March 5 to 13, 20 to 21, and 31 to April 1, 1894; Mr. Holzner from March 5 to 13 and 31 to April 1, 1894.

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[a] The creosote bush is abundant, extending to the Colorado River and down that stream to its mouth at the Gulf of California. On the rich soil of the lower Gila the finest specimens of cresote bush were seen, measuring almost 4 meters (13 feet) in height.

Reptiles of the Colorado River, from the mouth of the Gila to the Gulf of California.—Most of the lizards and snakes named in the following list were first collected at Fort Yuma by Maj. George H. Thomas (who became major-general during the civil war and to whose enthusiastic efforts science is also indebted for the first knowledge of the Fort Yuma ground squirrel, *Spermophilus tereticaudus* Baird, and other animals of the region). Others who have gathered reptiles in the Yuma region are Dr. A. L. Heermann, Arthur Schott, H. B. Möllhausen, R. O. Abbott, Charles R. Orcutt, and the naturalists of the U. S. Fish Commission:

Lizards.

Dipsosaurus dorsalis (Baird and Girard).
Sauromalus ater Duméril.
Callisaurus draconoides ventralis (Hallowell).
Uma rufopunctata Cope.
Uta stansburiana Baird and Girard.
Uta ornata Baird and Girard.
Uta symmetrica Baird.
Uta graciosa (Hallowell).
Sceloporus clarkii Baird and Girard.
Anota maccallii Hallowell.
Eublepharis variegatus (Baird).
Cnemidophorus tessellatus tessellatus (Say).

Snakes.

Glauconia humilis (Baird and Girard).
Zamensis flagellum flagellum (Shaw).
Zamensis semilineatus Cope.
Ophibolus getulus boylii (Baird and Girard).
Eutænia megalops Kennicott.
Eutænia elegans marciana (Baird and Girard).
Crotalus adamanteus atrox (Baird and Girard).
Crotalus cerastes Hallowell.

Turtles.

Gopherus agassizii (Cooper).
Kinosternon sonoriense Le Conte.

The range of the large land turtle (*Gopherus agassizii*) extends up the Colorado, at least to the Nevada line, where I found it in 1884. The Sonoran mud turtle (*Kinosternon sonoriense*) I do not remember to have seen below Gila City, on the Gila River. A large marine turtle was taken by Miguel, our Cocopah Indian hunter, near the mouth of the Colorado River and the head preserved in alcohol.

STATION No. 68.—Colorado River, at Monument No. 204 (western edge of the Yuma Desert), 855 kilometers (531 miles) west of the Rio Grande; altitude, 27 meters (89 feet). This camp was beside a laguna of the Colorado River, at the east edge of the bottom land. Willow, cottonwood, and mesquite are the prevailing trees, and arrowwood, hemp, and amaranth the characteristic undergrowth. Mr. Holzner occupied this station from March 13 to 31, 1894, and the writer from March 13 to 23 and 30 to 31, 1894. Collecting was extended across the western half of the Yuma Desert and across the bottom land to the edge of the Colorado River. Nowhere were larger collections made in the same length of time.

Flora of lower Colorado River.—The vegetation from the mouth of the Gila to the Gulf of California is disappointing to a stranger expecting to view tropical scenery. Beyond the broad river bottom, which is subject to regular seasonal overflowing, the Colorado is laterally bounded by broad and barren deserts, the Yuma Desert on the east and the Colorado Desert on the west. The river channel is marked by a line of unusually tall cottonwoods and a lesser fringe of willows (*Salix fluviatilis*). The adjacent bottom lands are covered more or less with mesquite and tornillo (*Prosopis glandulosa* and *P. odorata*). The common shrubbery is a dense and monotonous growth of arrowwood (*Pluchea sericea*) and, in places, of *Baccharis*. There are but few cacti, and these only in the hilly granite country in the vicinity of Yuma. No species of cactus, *Yucca*, *Agave*, *Nolina*, or *Dasylirion* was seen on the flat country between Yuma and the Gulf nor on the bordering deserts. Gourds and spiny asters cover the ground not otherwise occupied for several miles below Yuma. Then, about 26 kilometers (16 miles) below Yuma begins a rank growth of wild hemp that extends to the Gulf of California. This plant is 2 to 6 meters high, varying according to soil and moisture, and commonly grows with a coarse species of amaranth, which attains about the same height. Elder (*Sambucus glauca*) grows sparingly along the Colorado banks and is commonly cultivated in the settlements. About Yuma, most mesquite trees are small and heavily laden with globular masses of mistletoe. Farther south the parasite is less abundant and the trees larger, though inclined to a prostrate, straggling growth, many trunks arising from a single bole, the branches radiating and drooping, so that the terminal twigs sweep the ground or are buried in the soil. Some of these trees are very large, covering an area of 50 meters or more in diameter. The bark is much gnawed off by an arboreal species of the wood rat (*Neotoma cumulator*), whose bulky nest of sticks, coyote melons, and rubbish is built up into the dependent branches. A coarse *Ephedra* has a predilection for the slopes between the edge of the desert mesa and the river bottom. Wild tobacco (*Nicotiana glauca*) grows along the Colorado and its acequias, having probably escaped from cultivation. A small native species is also common. The indigo thorn, palo verde, and ironwood only occur on the granite hills about Yuma. The cockle (*Xanthium*) and a coarse *Cyperus* cover sandy banks; and, as the river broadens toward its mouth, vast savannas, canebrakes, and tule and carrizo marches are encountered. From what has been said it will be seen that the region has little that is distinctively tropical in its flora, its most peculiar feature consisting in the dense growth of willows strung with coyote melons and thickly mixed with stout amaranths and tall hemp, making jungles almost as difficult to penetrate as the canebrakes.

Station No. 69.—Left (east) bank of the Colorado River, at Monument No. 205, 859 kilometers (534 miles) west of the Rio Grande. Altitude, 26 meters (85 feet). Frequent visits were made to the bank of the Colorado by the writer; and Mr. Holzner trapped mammals there in March, 1894.

Station No. 70.—Las Carpas, Colorado river bottom, Sonora, Mexico, 24 kilometers (15 miles) south of Monument No. 205. Altitude, about 20 meters (66 feet). I camped there March 29 to 30, 1894.

Station No. 71.—Cienega Well, Sonora, Mexico, 40 kilometers (25 miles) south of Monument No. 205. The Colorado bottom is many miles in width at this part and covered by carrizo, cane, tule, and other semiaquatic vegetation, with mesquites on the drier places and willow and cottonwood beside the marshes and lagunas. I camped there March 23 to 24, 1894.

Station No. 72.—Colonia Diaz, Colorado River, Sonora, Mexico, 48 kilometers (30 miles) south of Monument No. 205. This fertile tract of the Colorado River bottom was visited by myself and an Indian assistant March 29 and 30, 1894. The town was found to be nearly deserted, only three houses being occupied by Mexicans at the time of our visit. Indians burn off the carrizo marshes and stretches of hemp and amaranth at this season, destroying much animal and plant life. The savannas are covered with wing-leaf grass mixed with patches of tule and triangular-stemmed bulrushes.

Station No. 73.—Left (east) bank of the Colorado River, opposite the mouth of Hardy River, Sonora, Mexico. The Colorado is salt at this place and subject to the ocean tides. My camp was located on a marshy bank at the lowest point we were able to reach with an escort wagon drawn by eight stout mules. In getting to it we crossed the last ridges on which mesquites could exist, all beyond being impassable if wet. Above these flats, which are inundated when the water in the Colorado is high, and also by the high monthly tides, we crossed the last ridges on which mesquites could exist, all beyond being bare flats or green savannas. The tide creeks and broad bays about our camp were swarming with waterfowl, which were nowhere else seen in so great abundance. Pelicans, cormorants, geese, ducks, cranes, herons, and small waders almost covered the shores and bays; the sky was lined with their ever-changing geometrical figures, and the air resounded with their winnowing wing-strokes and clanging voices, not only during the day, but through most of the night. The savannas were inhabited by small birds and mammals and were roamed over by herds of feral hogs, descended from good Berkshire stock. The writer, who was at this place from March 24 to 29, 1894, collected plants, mollusks, crustaceans, fishes, reptiles, birds (40 specimens), and mammals (71 specimens). A Cocopah Indian, named Miguel, rendered great assistance in obtaining specimens at this place, and subsequently accompanied us for some distance.

STATION NO. 74.—Old Fort Yuma, San Diego County, California. This abandoned military post is on a low bluff overlooking the Colorado River and the new town of Yuma, Arizona. Our camp was made among the willow and mesquite trees, just below the fort, and occupied by myself and Mr. Holzner from April 1 to 6, 1894.

STATION NO. 75.—Cooks Well, Salton River, Lower California, Mexico. The shallow lagunas of the Salton slough were the home of myriads of swimming and wading birds; the mesquite groves were also inhabited by numerous species of mammals and birds; but the back country, away from the water, is an arid waste of drifting sand, characteristic of much of the Colorado Desert. This station, which was occupied by the writer and his assistant April 7 and 8, 1894, is about 5 kilometers (3 miles) south of Monument No. 210, 22 kilometers (14 miles) west of the Colorado River (at Monument No. 206), and 205 kilometers (127 miles) east of the Pacific Ocean (at Monument No. 258). Altitude of station, 28 meters (92 feet).

STATION NO. 76.—Seven Wells, Salton River, Lower California. This station is 8 kilometers (5 miles) south of Monument No. 213, 39 kilometers (24 miles) west of the Colorado River, and 188 kilometers (117 miles) east of the Pacific Ocean. Altitude of station, 19 meters (62 feet). A broad band of green foliage marks the course of the stream, which flows with a good current at this part past grassy banks and islands of cat-tails, amid patches of arrowwood, *Baccharis*, and spiny aster. The surrounding country is covered with sand hills and ridges, topped with bushy mesquites and dotted with creosote bushes. Along the stream the mesquites grow into trees having distinct trunks. Beneath them one usually sees the nest of the wood rat, well piled with the fruit of the gourd known as the coyote melon. The willow thickets abounded with singing birds, and water fowl were very abundant and tame. At this camp, Hospital Steward, Ludwig Schoenefeldt, who joined my detachment at Yuma, began his collection of plants, which was continued, with interruptions, until August 29, 1894, when we left Station No. 102, on San Clemente Island.[a] Plants, mollusks, fishes, batrachians, reptiles, birds, and mammals were collected at this station from April 8 to 18, 1894, by myself and my assistant.

Station No. 77.—Gardners Laguna, Salton River, Lower California. Station about 10 kilometers (6 miles) south of Monument No. 216, 59 kilometers (37 miles) west of the Colorado River, and 168 kilometers (104 miles) east of the Pacific Ocean. Altitude of station, 16 meters (52 feet). Camp was made in a dense thicket of tall mesquites, on the north bank of a laguna a mile in length. There were a number of other lagunas, large and small, in the vicinity. All contained fishes and aquatic birds in abundance. Thickets of arrowwood bordered the stream, and mesquites, as usual, crowned the neighboring sand hills, among which were areas of creosote and greasewood bushes, sage brush, and desert weeds. Willows and an occasional cottonwood tree bordered the stream. This camp was occupied from April 18 to 27, 1894, by myself and assistants.

Station No. 78.—Laguna of Salton River, Lower California. Station about 2 kilometers (1.5 miles) south of Monument No. 217, 58 kilometers (36 miles) west of the Colorado River, and 169 kilometers (105 miles) east of the Pacific Ocean. Altitude, 9 meters (30 feet). I visited this place several times while camped at Gardners Laguna, and, with Mr. Holzner, camped there April 27 to 28, 1894, and collected specimens, among them examples of the wandering tattler, tree swallow, and other interesting birds.

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[a] The great majority of the plants gathered by the International Boundary Commission, United States and Mexico, were personally collected by myself, the rest as follows:

David Du B. Gaillard, first lieutenant, U. S. Army, member of the International Boundary Commission, frequently brought specimens of plants to the collectors in the field during the progress of the survey.

Frank Wagner, hospital steward, U. S. Army, collected plants along the parallel 31° 47′ and meridian section 108° 12′ 30″ (from El Paso, Texas, to Monument No. 53) during the period from August to November, 1892.

Harlan E. McVay, first lieutenant, U. S. Army, collected a few plants between the San Pedro and Colorado rivers.

Timothy E. Wilcox, major, U. S. Army, forwarded plants for the boundary collection from Fort Huachuca, Arizona, during the summer and autumn of 1893. These were in addition to the extensive collections sent by him personally, which latter were subsequently forwarded by Mr. F. V. Coville to Dr. N. L. Britton, to form a part of the material upon which Doctor Britton's list of the plants of the Huachuca Mountains was based.

Ernest C. Merton, acting hospital steward, U. S. Army, collected plants between the San Pedro River and Dog Spring, along parallel 31° 20′ (Monuments Nos. 98 to 55, from August 1 to September 23, 1893.

Frank Xavier Holzner, collector to assist the writer, employed by the U. S. National Museum from January 30 to December 10, 1892, and June 1, 1893, to July 20, 1894, gathered a few specimens of plants from time to time and made a considerable collection on the Huachuca Mountains, Arizona.

STATION No. 79.—Unlucky Lake, New River, San Diego County, California. Station about 4 kilometers (2 miles) north of Monument No. 221, 77 kilometers (47 miles) west of the Colorado River, and 150 kilometers (94 miles) east of the Pacific Ocean. Altitude, 2 meters (7 feet) below the level of the sea. The vegetation is about the same as that along Salton River. As on all of the waters of the Colorado Desert, fish and fowl were here very abundant. My detachment camped here from April 28 to May 3, 1894.

STATION No. 80.—Indian Wells, New River, San Diego County, California. Station about 10 kilometers (6 miles) north of Monument No. 223, 96 kilometers (60 miles) west of the Colorado River, and 131 kilometers (81 miles) east of the Pacific Ocean. Altitude, 6 meters (20 feet) below the level of the sea. Except at the wells, the river was dry at this point. I visited this station May 3, 1894, and Mr. Holzner camped there May 5 to 6, 1894.

STATION No. 81.—Laguna Station, Colorado Desert, San Diego County, California. Station about 11 kilometers (7 miles) north of Monument No. 224, 104 kilometers (65 miles) west of the Colorado River, and 123 kilometers (76 miles) east of the Pacific Ocean. Altitude, 9 meters (30 feet) below the level of the sea. This part of New River is bordered by arrowwood, mesquite, and a few desert weeds and shrubs. My detachment camped here from May 3 to 6, 1894.

STATION No. 82.—Signal Mountain, Colorado Desert, Lower California, Monument No. 224, 92 kilometers (58 miles) west of the Colorado River, and 135 kilometers (83 miles) east of the Pacific Ocean. Highest altitude, 811 meters (2,661 feet). Visited from Station No. 81 in May, 1894, when Mr. Schoenefeldt collected plants. The ocotillo was again found here.

STATION No. 83.—Coyote Well, Colorado Desert, San Diego County, California. Station 13 kilometers (8 miles) north of Monument No. 229, 127 kilometers (79 miles) west of the Colorado River, and 100 kilometers (62 miles) east of the Pacific Ocean. Altitude, 100 meters (328 feet). This barren place, without wood or water, was occupied by my party from May 6 to 8, 1894. A few plants, reptiles, birds, mammals, and rocks were collected.

STATION No. 84.—Eastern base of the Coast Range Mountains, San Diego County, California. This station was at the lowest water in the canyon through which the San Diego wagon road passes, about 8 kilometers (5 miles) north of Monument No. 230, 129 kilometers (81 miles) west of the Colorado River, and 98 kilometers (60 miles) east of the Pacific Ocean. Altitude, 560 meters (1,837 feet). This canyon had a fiery temperature. Ephedras, cacti, and a few mesquites and desert willows grew in the canyon, and there was considerable shrubbery on the hills above the camp, which was occupied by my party from May 7 to 9, 1894.

As soon as this station was reached some of the animals and plants peculiar to the San Diego or Pacific Coast Tract appeared, although many of the desert forms ascended for some distance the canyons and eastern slopes of the Coast Range Mountains, a few of them actually passing through the lowest gaps in the range to the Pacific side.

Vegetation.—The traveler who has crossed the Colorado Desert looks back upon its wastes of sand, dotted with the creosote bush, with a feeling of abhorrence, and views the sweltering cliffs at the base of the Coast Range with favor, however grim and uninviting they may appear to one approaching them from the opposite direction. The green tops of the yucca, and even the despised cactus, are a positive pleasure to the eye; and if one is fortunate enough to find a spring and a grove of fanleaf palms (*Neowashingtonia filamentosa*) in the first canyon that he enters his contentment is complete. There are no palms in the canyon through which the San Diego wagon road passes; but its course is marked far out upon the sloping desert by a line of tree yuccas (*Yucca mohavensis* Sargent), succeeded by desert willows, mesquites, and cat's claws, at the mouth of the canyon, which is choked with *Hymenoclea*, arrowwood, and *Baccharis*. Growing upon the rocky walls of the canyon are the *Zizyphus* and *Ephedra*, besides *Nolina parryi* Watson, *Agave deserti* Engelmann, *Simmondsia californica* Nuttall, and the familiar choya, bisnaga, and ocotillo. Here, also, we took a final leave of the indigo thorn, whose fragrant, violet-colored flowers covered the white sand.

Reptiles.—In the general region of the boundary, on the Colorado Desert, between the Colorado River and the Coast Range (Monuments Nos. 206 to 229), the following-named reptiles have been taken:

Lizards.

Dipsosaurus dorsalis (Baird and Girard).
Crotaphytus collaris (Say).
Crotaphytus wislizenii Baird and Girard.
Sauromalus ater Duméril.
Callisaurus draconoides ventralis (Hallowell).
Uma rufopunctata Cope.
Uta mearnsi Stejneger.
Uta stansburiana Baird and Girard.
Uta symmetrica Baird.
Sceloporus clarkii Baird and Girard.
Anota platyrhina (Girard).
Eublepharis variegatus (Baird).

Snakes.

Lichanura roseofusca Cope.
Lichanura orcutti Stejneger.
Zamenis flagellum flagellum (Shaw).
Pityophis catenifer (Blainville).
Chionactis occipitalis annulatus Kennicott.
Eutænia elegans marciana (Baird and Girard).
Crotalus adamanteus atrox (Baird and Girard).
Crotalus cerastes Hallowell.

STATION No. 85.—Mountain Spring, San Diego County, California. This station is about halfway up the east slope of the Coast Range and has an altitude of 775 meters (2,543 feet), the highest neighboring point reaching 1,410 meters (4,626 feet) in height. Mountain Spring is about 6.5 kilometers (4 miles) north of Monument No. 231, 135 kilometers (84 miles) west of the Colorado River, and 92 kilometers (57 miles) east of the Pacific Ocean. There are some rushes and a few mesquite and screw-bean trees around the spring, and much underbrush, yucca, cacti, and ephedras on the surrounding hills. A little higher up the slopes the juniper zone begins, and vegetation becomes more luxuriant. The mammals that were collected here were of much interest, as some of them were intergrades between the forms of the Colorado Desert and those of the Pacific Coast Tract. My party remained at this place from May 9 to 16, 1894.

Reptiles and batrachians.—The following-named species have been taken on the east side of the Coast Range:

Lizards.

Crotaphytus collaris (Say).
Sauromalus ater Duméril.
Callisaurus draconoides ventralis (Hallowell).
Uta mearnsi Stejneger.
Uta stansburiana Baird and Girard.
Sceloporus orcutti Stejneger.
Sceloporus vandenburgianus Cope.
Phrynosoma blainvillei Gray.
Zablepsis henshawi Stejneger.
Verticaria beldingi Stejneger.

Snakes.

Lichanura roseofusca Cope.
Zamensis flagellum flagellum (Shaw).
Rhinechis elegans (Kennicott).
Pityophis catenifer (Blainville).
Hypsiglena ochrorhyncha Cope.
Crotalus ruber Cope.
Crotalus confluentus lucifer (Baird and Girard).
Crotalus mitchelli Cope.

Batrachians.

Hyla regilla Baird and Girard.
Bufo columbiensis Baird and Girard.

Station No. 86.—West side, near summit of Coast Range mountains, San Diego County, California. This station is 5 kilometers (3 miles) north of Monument No. 232, 138 kilometers (86 miles) west of the Colorado River, and 89 kilometers (55 miles) east of the Pacific Ocean. Altitude, 950 meters (3,117 feet). The writer and Mr. Holzner were at this place May 16 and 17, 1894.

Flora of Wagon Pass.—This pass reaches the zone of California juniper and single-leaf piñon, and belongs to the Upper Austral Life Zone, barely penetrating the Transition Zone on the highest neighboring peaks, which do not rise above 1,410 meters (4,626 feet).[a] To the west is the beautiful Jacumba Valley. The following is a list of the trees, shrubs, and coarser plants observed from Station No. 85 (altitude, 775 meters, or 2,543 feet), on the east side, to Station No. 87 (altitude 860 meters, or 2,822 feet), on the west side of the Coast Range Divide:

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[a] A list of the trees and shrubs of the upper Austral (Transition) and lower Boreal (Canadian) zones is given in the description of Station No. 92, about 30 kilometers (19 miles) north of Monument No. 240, in a high part of the Coast Range.

The trees are:

Pinus mononophylla Torrey and Fremont.
Juniperus californica Carrière.
Yucca mohavensis Sargent.
Salix fluviatilis Nuttall.
Salix argophylla Nuttall.
Salix sp.
Populus fremontii Watson.
Quercus dumosa Nuttall.
Quercus agrifolia Née.
Cercocarpus parvifolius betuloides (Nuttall) Sargent.
Prunus ilicifolia (Nuttall) Walpers.
Acacia greggii Gray.
Prosopis odorata Torrey and Fremont.
Prosopis glandulosa Torrey.
Adenostoma sparsifolium Torrey.
Chilopsis linearis (Cavanilles) Sweet.
Sambucus glauca Nuttall.

Shrubs and coarse plants other than trees are:

Ephedra sp.
Yucca whipplei Torrey.
Nolina parryi Watson.
Agave deserti Engelmann.
Atriplex sp.
Anemopsis californica (Nuttall) Hooker and Arnott.
Ribes malvaceum Smith.
Adenostoma fasciculatum obtusifolium Watson.
Krameria parvifolia Bentham.
Krameria canescens Gray.
Pæonia brownii Douglas.
Amorpha californica Nuttall.
Fouquieria splendens Engelmann.
Covillea tridentata (de Candolle) Vail.
Simmondsia californica Nuttall.
Rhus ovata Watson.
Rhamnus tomentella Bentham.
Ceanothus leucodermis Greene.
Echinocactus lecontei Engelmann.
Opuntia (*Platopuntia* and from *Cylindropuntia*).
Arctostaphylos sp.
Menodora spinescens Gray.
Eriodictyon crassifolium Bentham.
Symphoricarpos racemosus Michaux.
Cucurbita palmata Watson.
Pluchea sericea (Nuttall) Coville.
Hymenoclea salsola Torrey and Gray.

Station No. 87.—Jacumba Hot Springs, San Diego County, California. Station about 1 kilometer (.6 mile) north of Monument No. 233, 130 kilometers (81 miles) west of the Colorado River, and 87 kilometers (54 miles) east of the Pacific Ocean. Altitude, 860 meters (2,822 feet). My party remained here from May 17 to 31, 1894, making general collections.

Station No. 88.—Ojo, in Nachoguero Valley, Lower California, 0.16 kilometer (0.1 mile) south of the International Boundary. Nearest Monument No. 237. This station, which is 146 kilometers (91 miles) west of the Colorado River and 71 kilometers (44 miles) east of the Pacific Ocean, has an altitude of 1,045 meters (3,429 feet). Occupied by my party from May 31 to June 7, 1894.

Station No. 89.—Campo, San Diego County, California, 1.6 kilometers (1 mile) north of Monument No. 240, 156 kilometers (97 miles) west of the Colorado River, and 61 kilometers (38 miles) east of the Pacific Ocean. This station, which has an altitude of 780 meters (2,559 feet), was occupied by my party from June 7 to 8 and 23, 1894. (Plate XIII, fig. 2.)

STATION No. 90.—J. M. Gray's Ranch, San Diego County, California, about 14.5 kilometers (9 miles) nearly north of Monument No. 240, 169 kilometers (105 miles) from the Colorado River, and 61 kilometers (38 miles) from the Pacific Ocean. This station was occupied by my party from June 8 to 9, 1894.

STATION No. 91.—Thomas Cameron's Ranch, San Diego County, California, 13 kilometers (8 miles) nearly north of Monument No. 240, 167 kilometers (104 miles) from the Colorado River, and 60 kilometers (37 miles) from the Pacific Ocean. Station occupied from June 21 to 23, 1894.

STATION No. 92.—Campbell's Ranch, at Laguna Mountains (Coast Range), San Diego County, California, 31 kilometers (19 miles) north of Monument No. 240, 187 kilometers (116 miles) from the Colorado River, and 92 kilometers (57 miles) from the Pacific Ocean. This station, which has an altitude of 1,675 meters (5,496 feet), was occupied by my party from June 9 to 21, 1894. To Mr. Campbell, the owner of the ranch, we were indebted for the privilege of occupying his house and carrying on the work with the greatest comfort, while his employees aided us in various ways. This station lies in the Transition Zone, the highest peaks extending well into the Canadian or lowest section of the Boreal Zone. We did not visit Cuyamaca Mountain, the highest peak of the region, about 10 kilometers (6 miles) distant.

Flora of Laguna Mountains.—The lists below give the different varieties of plant life found in the vicinity of this station.

The following is a list of the trees collected:

Pinus sabiniana Douglas.
Pinus coulteri Lambert.
Libocedrus decurrens Torrey.
Salix nigra Marshall.
Quercus dumosa Nuttall.
Quercus chrysolepis Liebmann.
Quercus wislizeni A. de Candolle.
Quercus californica (Torrey) Cooper.
Umbellularia californica (Hooker and Arnott) Nuttall.
Platanus racemosa Nuttall.
Amelanchier alnifolia Nuttall.
Heteromeles arbutifolia (Poiret) Roemer.
Prunus demissa (Nuttall) Walpers.
Prunus ilicifolia (Nuttall) Walpers.
Rhamnus crocea Nuttall.

Other conspicuous plants are:

Rosa californica Chamisso and Schlechtendal.
Rhamnus tomentella Bentham.
Ceanothus leucodermis Greene.
Ceanothus rigidus Nuttall.
Ceanothus palmeri Trelease.
Garrya sp.
Eriodictyon crassifolium Bentham.
Symphoricarpos oreophilus Gray.
Symphoricarpos racemosus Michaux.
Arctostaphylos sp.

STATION No. 93.—Tecate River, Lower California, 1.6 kilometers (1 mile) south of Monument No. 245, 175 kilometers (109 miles) west of the Colorado River, and 43 kilometers (27 miles) east of the Pacific Ocean. Altitude 520 meters (1,706 feet). This station, which is located on the right bank of the Tecate River, at the foot of Tecate Mountain (altitude 1,185 meters, or 3,888 feet), was occupied by my party from June 23 to 27, 1894.

Station No. 94.—San Isidro Ranch, Lower California, about 3 kilometers (2 miles) south of Monument No. 250, 190 kilometers (118 miles) from the Colorado River, and 31 kilometers (19 miles) from the Pacific Ocean. This station, which was occupied from June 27 to July 3, 1894, was located on a stream near its origin in a large spring in a nearly inclosed hollow of the Cerro de San Isidro.

Station No. 95.—Jamul Creek, at the old date palm tree, between Dulzura and El Nido, San Diego County, California. This station, which was occupied by my party from July 3 to 9, 1894, is 11 kilometers (7 miles) north of Monument No. 251, 204 kilometers (127 miles) from the Colorado River, and 24 kilometers (15 miles) from the Pacific Ocean.

Station No. 96.—Pacific Ocean at the mouth (south side) of Tijuana River, 217 kilometers (135 miles) west of the Colorado River and near the last Boundary Monument (No. 258). My party was encamped at this place from July 9 to 20, 1894. Mr. Frank X. Holzner left the party July 20, 1894, on which date we reached San Diego.

Flora of Pacific slope of the Coast Range Mountains.—Following is a list of the trees and other conspicuous plants observed by us between Jacumba Hot Springs (Monument No. 233) and the mouth of the Tijuana River (Monument No. 258), on the Boundary Line. A list of the coarse vegetation at the summits of the Coast Range, north of the Boundary Line, has been given in the description of Station No. 92.

The trees are:

Pinus monophylla Torrey and Frémont.
Cupressus goveniana Gordon.
Juniperus californica Carrière.
Yucca mohavensis Sargent.
Salix nigra Marshall.
Salix laevigata Bebb.
Salix fluviatilis Nuttall.
Salix lasiolepis Bentham.
Populus fremontii Watson.
Alnus oregona Nuttall.
Quercus engelmanni Greene.
Quercus dumosa Nuttall.
Quercus agrifolia Née.
Platanus racemosa Nuttall.
Cercocarpus parvifolius betuloides (Nuttall) Sargent.
Heteromeles arbutifolia (Poiret) Roemer.
Prunus ilicifolia (Nuttall) Walpers.
Acacia greggii Gray.
Prosopis glandulosa Torrey.
Adenostoma sparsifolium Torrey.
Fremontodendron californicum (Torrey) Coville.
Rhus integrifolia (Nuttall) Bentham.
Opuntia prolifera Engelmann.
Arctostaphylos sp.
Sambucus glauca Nuttall.

Other Pacific-slope plants are:

Ephedra sp.
Yucca whipplei Torrey.
Scirpus occidentalis (Watson) Chase.
Agave deserti Engelmann.
Agave shawii Engelmann.
Eriogonum sp.
Atriplex sp.
Anemopsis californica (Nuttall) Hooker and Arnott.
Basilima millefolium (Torrey) Greene.
Adenostoma fasciculatum obtusifolium Watson.
Rosa californica Chamisso and Schlechtendal.
Pæonia brownii Douglas.
Amorpha californica Nuttall.
Rhus ovata Watson.
Rhus laurina Nuttall.
Rhus trilobata Nuttall.
Rhamnus tomentella Bentham.
Ceanothus leucodermis Greene.
Vitis girdiana Munson.
Cereus emoryi Engelmann.
Opuntia (*Platopuntia* and *Cylindropuntia*).
Arctostaphylos sp.
Romneya coulteri Harvey.
Menodora spinescens Gray.
Eriodictyon crassifolium Bentham.
Symphoricarpos racemosus Michaux.
Cucurbita fœtidissima Humboldt, Bonpland, and Kunth.
Pluchea sericea (Nuttall) Coville.
Baccharis glutinosa Persoon.
Hymenoclea salsola Torrey and Gray.
Artemisia sp.

The coastal strip of San Diego County is quite generally cultivated. Orchards and groves of fruit trees are numerous; and many exotic plants have become naturalized, among them several species of the palm, the pepper-tree (*Schinus molle* Linnæus), and the tronadora (*Nicotiana glauca* Graham), besides an abundance of the eucalpytus. Coarse, flat-jointed *Opuntiæ* are grown for hedges, in some instances having reached a height of 6 meters (20 feet).

STATION No. 97.—San Diego, California, 21 kilometers (13 miles) north of the International Boundary. This was our base camp from July 20 to September 9, 1894. Collections were made by myself from July 20 to August 3, August 15 to 22, and August 29 to September 9, 1894.

Reptiles and Batrachians of San Diego region.—The following-named species have been taken on the Pacific slope of San Diego County:[a]

Turtles.

Emys nigra Hallowell.

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[a] This list is doubtless quite incomplete. The most energetic collectors in this field were Miss Rosa Smith, Dr. Thomas H. Streets, U. S. N., General Emory, Lieut. W. P. Trowbridge, and Dr. W. A. Hammond, U. S. A., Drs. J. G. Cooper and J. L. Le Conte, and R. E. C. Stearns, David Starr Jordan, Messrs. Charles R. Orcutt, Charles H. Townsend, H. W. Henshaw, A. W. Anthony, Andrew Cassidy, and the author.

Lizards.

Uta mearnsi Stejneger.
Uta stansburiana Baird and Girard.
Sceloporus orcutti Stejneger.
Sceloporus undulatus undulatus (Latreille).
Sceloporus biseriatus Hallowell.
Sceloporus vandenburgianus Cope.
Phrynosoma blainvillei Gray.
Phrynosoma coronatum (Blainville).
Gerrhonotus multicarinatus Blainville.
Xantusia riversiana Cope.
Verticaria hyperythra Cope.
Eumeces skiltonianus (Baird and Girard).
Anniella pulchra Gray.

Snakes.

Lichanura roseofusca Cope.
Lichanura simplex Stejneger.
Zamensis constrictor (Linnæus).
Zamensis flagellum flagellum (Shaw).
Zamensis lateralis lateralis (Hallowell).
Salvadora grahamiæ (Baird and Girard.
Rhinechis elegans (Kennicott).
Pityophis catenifer (Blainville).
Ophibolus pyrrhomelas Cope.
Ophibolus getulus boylii (Baird and Girard).
Ophibolus getulus californiæ (De Blainville).
Rhinochilus lecontei Baird and Girard).
Hypsiglena ochrorhyncha Cope.
Eutænia elegans couchii (Kennicott).
Eutænia elegans couchii (Kennicott).
Crotalus confluentus confluentus Say.
Crotalus confluentus lucifer (Baird and Girard).
Crotalus ruber Cope.

Crotalus adamanteus atrox (Baird and Girard) is reported by Dr. Thomas H. Streets, U. S. N., from Los Coronados Islands, Pacific coast of Lower California,[a] which are in sight from the last Boundary Monument (No. 258).

Batrachians.

Diemyctylus torosus (Eschscholtz).
Bufo columbiensis Baird.
Hyla regilla Baird.[b]

STATION No. 98.—Ocean Beach, near San Diego, California, 26 kilometers (16 miles) north of Monument No. 258. Here with Mr. Schoenefeldt I made collections of birds, mollusks, crustaceans, and plants, August 17 and 19, 1894.

STATION No. 99.—La Jolla, San Diego County, California, 37 kilometers (23 miles) north of Monument No. 258. Sea shells and plants were collected, August 12, 1894.

STATION No. 100.—Alpine, San Diego County, California, 29 kilometers (18 miles) north of Monument No. 247. Altitude 693 meters (2,275 feet). The writer made general collections at this place, August 3 to 7 and 14 to 15, 1894; Mr. Schoenefeldt having collected plants during the same periods. This station was in the lower edge of the zone occupied by the evergreen white oak (*Quercus engelmanni*), which crosses the boundary at Portrero. The Californian live oak (*Quercus agrifolia*) and the sycamore (*Platanus racemosa*) were also abundant, as was the sumach (*Rhus diversiloba* Torrey and Gray).

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[a] Bulletin No. 7, U. S. National Museum, 1877, p. 40.

[b] For an account of the mollusks of this region, see Reports on the Mollusks collected by the International Boundary Commission of the United States and Mexico, 1892–1894, Proc. U. S. Nat. Mus., XIX, 1896, pp. 333–379.

Station No. 101.—Pine Valley, San Diego County, California, 27 kilometers (17 miles) north of Monument No. 240. Altitude 1,280 kilometers (4,200 feet). The writer and Mr. Schoenefeldt collected from August 7 to 14, 1894. Trips were made from this camp to the Laguna Mountains of the Coast Range. The camp was located in a fine forest of the Sabine pine (*Pinus sabiniana* Douglas), near a stream bordered by the black willow (*Salix nigra* Marshall) and groves of live oak (*Quercus agrifolia* Née). On the neighboring hills were thickets of wild rose (*Rosa californica*) and manzanita (*Arctostaphylos*), together with the toyon or Christmas berry (*Heteromeles arbutifolia*). The red-shank chamiso (*Adenostoma sparsifolium*) was in full flower.

Station No. 102.—San Clemente Island, of the Santa Barbara group, California, 129 kilometers (80 miles) northwest of Monument No. 258, and about 97 kilometers (60 miles) from the nearest mainland of California. The island is 27 kilometers long and 6.5 wide (17 by 4 miles), and 457 meters (1,500 feet) in altitude. Through the courtesy of the Secretary of the Treasury, the writer, accompanied by Prof. T. S. Brandegee, Mr. A. W. Anthony, and Hospital Steward Ludwig Schoenefeldt, with a detachment of soldiers, were transported to Smugglers Cove, at the south end of the island, in the U. S. revenue cutter *Wolcott*, commanded by Captain Roath, to whom, as well as to the other officers of the ship, we were indebted for every possible assistance and polite attention. The party made general collections on San Clemente Island from August 22 to 29, 1894.

Flora of San Clemente Island.—The following list gives the botanical and wood specimens of trees that were obtained while on this island:[a]

Lyonothamnus floribundus asplenifolius (Greene) Brandegee.
Prunus integrifolia (Sudworth) Sargent.
Rhus integrifolia (Nuttall) Bentham.
Rhamnus crocea Nuttall.
Heteromeles arbutifolia (Poiret) Roemer.

Cacti covered the greater part of the south end of the island, making travel difficult. The species noted were *Cereus emoryi* Engelmann, *Opuntia lindheimeri littoralis* (Engelmann) Coulter, and *Opuntia prolifera* Engelmann. The island fox (*Urocyon littoralis*) and San Clemente house finch (*Carpodacus mexicanus clementis*) were feeding extensively upon the ripe fruit of the prickly pear (*Opuntia lindheimeri littoralis*). The rocks were covered with *Selaginella rupestris* and *Cotyledon;* and from the bank of a stream we obtained a huge tuberous root of an abundant species of *Echinocystis*. We collected species of *Eriogonum*, *Rhus*, *Convolvulus*, *Salicornia*, *Abronia*, *Solanum*, *Astragalus*, *Atriplex*, and many other genera.

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[a] See Zoe, I. No. 5, July, 1890, for a list of the Flora of San Clemente and other islands of the Santa Barbara group, by Prof. T. S. Brandegee.

Fauna of San Clemente Island.—The following lists show the specimens collected:

MOLLUSKS.[a]

Land mollusks.

Epiphragmophora intercisa Binney.
Epiphragmophora stearnsiana Gabb.
Epiphragmophora gabbi Newcomb.

Marine mollusks.

Acmæa pelta Eschscholtz.
Acmæa scabra Nuttall.
Astralium undosum Wood.
Cardium biangulatum Sowerby.
Chlorostoma aureotinctum Forbes.
Chlorostoma gallina Forbes.
Conus californicus Hinds.
Cypræa spadicea Gray.
Glyphis murina Carpenter.
Haliotis cracherodii Leach.
Haliotis fulgens Philippi.
Lucapina crenulata Sowerby.
Lucina californica Conrad.
Macoma nasuta Conrad.
Monoceros engonatum Conrad.
Mopalia muscosa Gould.
Muricidea incisa Broderip.
Nassa tegula Reeve.
Norrisia norrisii Sowerby.
Olivella biplicata Sowerby.
Psammobia rubroradiata Conrad.
Purpura ostrina Gould.
Ranella californica Hinds.
Scurria (Lottia) gigantea Gray.

Insects.

Ants, mosquitoes, bluebottle flies, kelp flies, spiders, beetles, yellow-banded wasps, butterflies, moths, dragonflies, and a large black fly were seen.

Lizards.

Uta stansburiana Baird and Girard.—Collected by the writer and A. W. Anthony, in August, 1894; by the U. S. Fish Commission (Charles H. Townsend[b]), two specimens, January 23.

Xantusia riversiana Cope.—"Several adults in fine condition. Nos. 15166–15175."[c]

Note.—No horned toads were found on San Clemente Island; but the writer carried over specimens of *Phrynosoma blainvillei* Gray, and liberated them at Smugglers Cove in August, 1894.

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[a] See Report on the Mollusks collected by the International Boundary Commission, Proc. U. S. Nat. Mus., XIX, pp. 373 to 378, January 27, 1897. The species listed above were all collected in August, 1894, by the author.

[b] Proc. U. S. Nat. Mus., XIII, 1890, p. 144.

[c] Cope, Proc. U. S. Nat. Mus., XII, 1899, p. 147.

No batrachian was collected on San Clemente Island, but *Hyla regilla* Baird, which Mr. Henshaw obtained on Santa Cruz Island, perhaps occurs there.

Birds.

The following-named species were observed by Mr. A. W. Anthony and the writer. Of those species which are marked with an asterisk (*), specimens were taken. Of water birds, only those actually seen upon the land are included.

*1. *Larus occidentalis* Audubon.
2. *Phalacrocorax dilophus albociliatus* Ridgway.
*3. *Phalacrocorax penicillatus* (Brandt).
*4. *Ardea herodias* (Linnaeus).
5. *Nycticorax nycticorax nævius* (Boddaert).
*6. *Crymophilus fulicarius* (Linnæus).
7. *Macrorhamphus scolopaceus* (Say).
*8. *Actodromas minutilla* (Vieillot).
*9. *Ereunetes maurii* Bonaparte.
10. *Helodromas solitarius cinnamomeus* (Brewster).
*11. *Heteractitis incanus* (Gmelin).
*12. *Actitis macularia* (Linnæus).
*13. *Ægialitis semipalmata* (Bonaparte).
*14. *Arenaria interpres morinella* (Linnæus).
*15. *Arenaria melanocephala* (Vigors).
*16. *Zenaidura macroura* (Linnæus).
17. *Haliæetus leucocephalus* (Linnæus).
18. *Falco peregrinus anatum* (Bonaparte).
*19. *Pandion haliaëtus carolinensis* (Gmelin).
*20. *Ceryle alcyon* (Linnæus).
*21. *Empidonax insulicola* Oberholser.
*22. *Otocoris alpestris insularis* C. H. Townsend.
*23. *Corvus corax clarionensis* Hartert.
*24. *Carpodacus mexicanus clementis* (Mearns).
*25. *Amphispiza belli clementeæ* Ridgway.
*26. *Melospiza cinerea clementæ* C. H. Townsend.
*27. *Pipilo maculatus clementæ* (J. Grinnell).
*28. *Lanius ludovicianus mearnsi* Ridgway.
*29. *Vermivora celata sordida* C. H. Townsend.
*30. *Salpinctes obsoletus* (Say).
*31. *Thryomanes bewickii leucophrys* (Anthony).

Mr. Charles H. Townsend visited San Clemente Island on May 8, 1888, and January 25, 1889, and published[a] descriptions of three new birds (Nos. 22, 26, and 29 of the above list), and gave a list of six other species collected on the island, including, besides Nos. 24, 25, 27, and 31, two species which we did not obtain:

*32. *Ptychoramphus aleuticus* (Pallas).
*33. *Speotyto cunicularia hypogæa* (Bonaparte).

In August, 1897, as publication No. 1 of the Pasadena Academy of Sciences, Mr. Joseph Grinnell published a report on the birds recorded during a visit to the islands of Santa Barbara, San Nicolas, and San Clemente in the spring of 1897, enumerating 31 species of land birds. In this, by far the most important contribution to the ornithology of the Santa Barbara Islands, the "Entire list of water birds observed" is consolidated, so that only four species of water birds (*Larus heermanni*, *Ardea herodias*, *Heteractitis incanus*, and *Arenaria melanocephala*) are specifically mentioned as inhabiting San Clemente Island, while, under the heading of *Oceanodroma melania*, the author observes:

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[a] Proc. U. S. Nat. Mus., XIII, 1890, pp. 139-140.

> Small petrels of some kind were heard at night on the east end of San Nicolas, and at Mosquito Harbor on San Clemente, but no trace of them was to be found by day. We searched diligently for their burrows, but failed entirely.

Mr. Grinnell's observations covered the periods from March 28 to April 3, and May 28 to June 7, 1897. His list includes Nos. 4, 11, 15, 16, 17, 19–31 of the present list, together with the following:

34. *Larus heermanni* Cassin.
35. *Lophortyx californicus vallicola* (Ridgway).
36. *Phalænoptilus nuttallii californicus* Ridgway.
37. *Aëronautes melanoleucus* (Baird).
38. *Calypte costæ* (Bourcier).
39. *Selasphorus alleni* Henshaw.
40. *Horizopus richardsonii* (Swainson).
41. *Sturnella neglecta* Audubon.
42. *Passerculus sandwichensis alaudinus* (Bonaparte).
43. *Zonotrichia leucophrys gambelii* (Nuttall).
44. *Zonotrichia coronata* (Pallas).
45. *Spizella socialis arizonæ* Coues.
46. *Melospiza lincolnii* (Audubon).
47. *Ampelis cedrorum* (Vieillot).
48. *Dendroica auduboni* (Townsend).
49. *Mimus polyglottos leucopterus* (Vigors).
50. *Hylocichla guttata* (Pallas).

Mammals.

Peromyscus sonoriensis clementis (Mearns).
Phoca largha Pallas.
Urocyon littoralis (Baird).
Myotis californicus (Audubon and Bachman).

Summary of collecting stations, together with the dates on which they were occupied.

Number of station.	Name of place.	Number of the nearest boundary monument (new series).	Altitude of collecting station.	When and by whom collections were made. (This refers to the biological collections as a whole.)
			Meters.	
1	Fort Worth, Tarrant County, Texas	1	193	Mearns and Holzner, Jan. 30-31, 1892. South Fork of Trinity River.
2	Fort Clark, Kinney County, Texas	1	308	Mearns, from Nov. 5, 1892, to June 6, 1893, and July 3-15, 1893. Plants collected in autumn and spring.
3	Fort Hancock, El Paso County, Texas	1	(*a*)	Mearns, from June 7 to July 3. 1893.
4	Belen Station, Southern Pacific R. R., El Paso County, Texas.	1	1,100	Mearns, on June 19, 1893.
5	El Paso, Texas	1	1,135	Mearns and Holzner, from Feb. 1 to Mar. 11, 1892; Mearns, in June, 1893; Wagner, in Aug. in 1892.
6	Rio Grande River, Chihuahua, opposite old Fort Bliss, Texas.	1	1,130	Mearns and Holzner, Mar. 14, 15, 1892.
7	Monument No. 15, near B. F. Wragg's ranch	15	1,280	Mearns and Holzner, from Mar. 20 to Apr. 7, 1892.
8	Lake Palomas, Mimbres Valley, Chihuahua	21	1,210	Mearns and Holzner, from Apr. 7 to 15, 1892. One of us made daily trips to the lake from our camp near Columbus (Monument 19).
9	Monument No. 23, near Columbus, New Mexico	23	1,211	Mearns and Holzner, from Apr. 7 to 15, 1892; Wagner.
10	Carrizalillo Springs, New Mexico	33	1,381	Mearns and Holzner, from Apr. 15 to 22, 1892. Many specimens came from the neighboring Carrizalillo Mountains; Wagner, 1892.
11	Upper corner monument, parallel 31° 47′	40	1,494	Mearns, from Apr. 22 to May 15, 1892; Holzner, from Apr. 22 to May 10, 1892; Wagner.
12	Big Hatchet Mountain, Grant County, New Mexico	43	2,545	Mearns, May 18 and 19, 1892; Holzner, May 18 to 25, 1892.
13	Mosquito Springs, Chihuahua	46	1,270	Mearns, from May 15 to 18 and 19 to 21, 1892; Holzner, from May 10 to 18, 1892; Wagner.
14	Lower corner monument, parallel 31° 20′	53	1,408	Mearns made occasional visits from camp No. 15, May 22 to June 10, 1892.
15	Dog Spring, Grant County, New Mexico	55	1,475	Mearns, May 21 to 30 and June 3 to 13, 1892; Sept. 15 to 23, 1893; Holzner, May 25 to June 13, 1892.
16	Whitewater, Chihuahua	61	1,528	Mearns, May 30 and 31, June 2, 3, 13 to 22, and 27 to 29, 1892; Sept. 10 to 15 and 23, 1893; Holzner, June 13 to 22 and 27 to 29, 1892.
17	Boundary line at the eastern base of the San Luis Mountains.	64	*b* 1,620	Mearns, June 2, 17, and 29, 1892; Sept. 23 and 24, 1893.

a Hospital reservation 2,500 feet.

b At monument.

Summary of collecting stations, together with the dates on which they were occupied—Continued.

Number of station.	Name of place.	Number of the nearest boundary monument (new series).	Altitude of collecting station.	When and by whom collections were made. (This refers to the biological collections as a whole.)
			Meters.	
18	Eastern base of the San Luis Mountains at San Francisco Canyon, Chihuahua.	63	1,800	Mearns, June 18, 19, and 22 to 27, 1892; Sept. 11, 1893; Holzner, June 22 to 27, 1892.
19	Summit of the San Luis Mountains	65	2,048	Mearns, May 31, 1892 (Cook's Pass); June 2 and 29, 1892 (Irwin's Pass); June 1, 1892 (San Luis Canyon); June 18, 19, and 22-27, 1892 (San Francisco Canyon); Sept. 11, 1893 (San Francisco Canyon); Sept. 24, 1893 (Irwin's Pass); July 5, 19, etc., 1892 (summit of highest peaks, from San Luis Springs); Aug. 31, Sept. 1, 4, 5, 6, and 7, 1893 (west slope from base to summit); Sept. 25, 26, 29, and Oct. 1 and 2, 1893 (west slope, from base to summit, generally in the vicinity of the San Luis Canyon); Holzner, June 22 to 27, 1892 (San Francisco Canyon); July 11 to 23, 1892 (San Luis Canyon).
20	San Luis Springs (Lang's ranch)	66	[a]1,577	Mearns, May 31 to June 2; June 29 to July 1; July 4 to 6 and 8 to 28, 1892; Aug. 31 to Sept. 10 and Sept. 24 to Oct. 2, 1893; Holzner, June 29 to July 11, and July 23 to 28, 1892.
21	Head of right fork of Cajon Bonito Creek, Chihuahua	67	1,375?	Mearns, from July 1 to 4, 21, and 23 to 24, 1892; Sept. 8, and 27-28, 1893.
21a	Animas Mountains, Grant County, New Mexico	65	(?)	Mearns, July, 1892.
22	Astronomers' camp, Animas Valley	67	1,573	Holzner crossed the Animas Valley on July 28, 1892. Members of the astronomical party sent some specimens from their camp at Monument No. 67 to us when at Lang's ranch. Mearns crossed the valley seven times, July 6, 8, 14, 18, and 28, 1892; Aug. 30 to 31, and Oct. 2, 1893.
23	Cloverdale, Grant County, New Mexico	69	1,600?	Mearns, July 14-18, 1892.
24	Hall's Ranch, Guadalupe Canyon, Sonora	73	1,267	Mearns, July 6 to 8, and 28 to 29, and Aug. 11, 1892; Aug. 24 to 30, and Oct. 2 to 4, 1893; Holzner, July 28 to 29, 1892.
25	San Bernardino Ranch	77	1,133	Mearns, July 6 to 7, and 29 to Sept. 11, 1892; Aug. 17 to 24, and Oct. 4 to 7, 1893; Holzner, July 29 to Sept. 11, 1892.
26	Near the mouth of Cajon Bonito Creek, Sonora	....	975	Mearns, Aug. 31 to Sept. 1, 1892.
27	Niggerhead Mountain (Cerro Gallardo)	82	[a]1,374	Mearns, Sept. 1 and 11, 1892; Aug. 14 to 17, and Oct. 7, 1893; Holzner, Sept. 11, 1892.
28	Piedras Negras, Sulphur Spring Valley	85	[a]1,204	Mearns, Sept. 11 to 12, 1892; Aug. 14 and Oct. 7, 1893; Holzner, Sept. 11 to 12, 1892.
29	Dutch Charley's Ranch	88	[a]1,316	Mearns, Sept. 12, 1892; Aug. 12 to 14, and Oct. 7 to 8, 1893 (Bisbee, Arizona, Oct. 8 to 10, 1893); Holzner, Sept. 12, 1892.
30	Johnston's Ranch, nearly south of Bisbee, Arizona	90	1,390	Mearns, Sept. 12 to Oct. 10, 1892; Aug. 12 and Oct. 8, 1893; Holzner, Sept. 12 to Oct. 2, and Oct. 7 to 10, 1892.
31	Bisbee, Arizona	91	1,700	Mearns made frequent visits from Sept. 12 to Oct. 10, 1892, and camped there from Oct. 8 to 10, 1893.

32	San Jose Mountain, Sonora	92	[b] 2,541	Mearns, Sept. 26 and Oct. 1, 1892; Aug. 4, and 5 to 12, 1893; Holzner, Oct. 2 to 7, 1892.
33	Johnston's steam pump	93	[a] 1,298	Mearns, Oct. 10, 1892; Aug. 2 to 5, 1893; Holzner, Oct. 10, 1892.
34	San Pedro River	98	1,298	Mearns, Oct. 10 to Nov. 1, 1892; July 27 to Aug. 2, and Oct. 10, 1893; Holzner, Oct. 10 to Nov. 2, 1892.
35	Huachuca Mountains	102	2,887	Mearns, Oct. 21 and 26, 1892; July 16 to 27, and 31, and Oct. 10 to 18, 1893; Holzner, July to Oct. 18, 1893.
36	Cienaga Ranch, Babacomari Creek, Arizona	106	....	Mearns and Holzner, Oct. 18 and 19, 1893.
37	Santa Cruz River at La Noria, Arizona	111	1,393	Holzner, Nov. 5 to 11, and 22 to Dec. 5, 1892; Oct. 19 and 20, 1893; Mearns, Oct. 19 and 20, 1893.
38	Patagonia Mountains	114	[a] 1,750	Holzner, Nov. 14 to 22, and 27, 1892.
39	Town of Santa Cruz, Sonora	111	1,355?	Mearns and Holzner, Oct. 20 to 23, 1893.
40	Second crossing of the Boundary Line on the Santa Cruz River, Sonora.	118	1,130	Holzner, Dec. —, 1892; May 27 to July 10, 1893.
41	Road-crossing of the Santa Cruz River, Sonora	118	1,140	Mearns and Holzner, Oct. 23 and 24, 1893.
42	Nogales, Arizona	122	1,174	Holzner, Dec. —, 1892; also shot Mexican white-tailed deer; Mearns and Holzner, Oct. 24 to 28, 1893.
43	Corner Monument, parallel 31° 20′, 8 miles west of Nogales	127	1,592	Holzner ; Mearns, Oct. 26, 1893.
44	Tumacacori Mission, Santa Cruz River, Arizona	127	1,000?	Mearns, Oct. 28 and 29, 1893 (Holzner rode *via* Crittenden).
45	Santa Cruz River, 25 miles south of Tucson, Arizona	....	865	Mearns, Oct. 29 and 30, 1893.
46	Tucson, Arizona	124	736	Mearns, Oct. 30 to Nov. 30, 1893, and Dec. 11 and 12, 1893; also April and May, 1885; Holzner, Oct. 30 to Nov. 5, and Nov. 17 to 28, 1893.
47	Old Fort Lowell, Arizona	118	615	Mearns, Apr. and May, 1885; Nov. 10 and 20, 1893; Holzner, Nov. 5 to 20, 1893.
48	Warsaw Mills, Arizona	133	1,220	Mearns, Dec. 1 to 7, 1893; Holzner, Nov. 29 to Dec. 7, 1893.
49	Arivaca Creek, Arizona	135	1,000?	Mearns, Dec. 8 and 9, 1893; Holzner, Dec. 7 and 8, 1893.
50	La Osa, Arizona	140	1,100	Mearns, Dec. 9, 10, and 11 to 28, 1893; Holzner, Dec. 8 to 28, 1893.
51	La Ventana, Arizona	145	675	Mearns and Holzner, Dec. 28 and 29, 1893.
52	Pozo de Luis, Sonora	151	700	Mearns and Holzner, from Dec. 29, 1893, to Jan. 8, 1894.
53	Nariz Temporal (Papago Indian village), Sonora	159	500	Mearns and Holzner, Jan. 8 and 9, 1894.
54	Santa Rosa Valley, in Sierra de la Nariz	161	[c] 516	Mearns and Holzner, Jan. 9, 1894.
55	Sonoyta, Sonora	168	400	Mearns and Holzner, Jan. 9, to 25, 1894.
56	Santo Domingo, Sonora	170	360	Mearns, Jan. 25, 1894; Holzner, Jan. 25, 1894.
57	Quitobaquita, Arizona	172	320	Mearns and Holzner, Jan. 25 to Feb. 8, 1894.
58	Rancho de Agua Dulce, Sonoyta River, Sonora	173	280	Mearns and Holzner, Feb. 8, 1894.
59	La Represo, Tule Desert, Sonora	179	210	Mearns and Holzner, Feb. 8 and 9, 1894.
60	Camel skeleton, Tule Desert	181	245	Mearns and Holzner, Feb. 9, 1894.
61	Tule Wells, Yuma County, Arizona	186	375	Mearns, Feb. 9 to 14, 1894; Holtzner, Feb. 10 to 14, 1794.

[a] At monument.

[b] Summit.

[c] Monument in valley.

Summary of collecting stations, together with the dates on which they were occupied—Continued.

Number of station.	Name of place.	Number of the nearest boundary monument (new series).	Altitude of collecting station.	When and by whom collections were made. (This refers to the biological collections as a whole.)
			Meters.	
62	Narrow range of Granite Mountains west of Tule Wells..	187	[a] 325	Mearns, Feb. 10, 12, 13, and 14, 1894.
63	Tinajas Altas, Yuma County, Arizona	191	[b] 335	Mearns and Holzner, Feb. 14 to 23, 1894.
64	Yuma Desert..	200	45	Mearns, Feb. 14 and Mar. 15 and 16, 1894.
65	Gila River at Adonde siding, Southern Pacific R. R., Arizona.	197	60	Mearns and Holzner, Feb. 23 to Mar. 1, 1894.
66	Gila River at Gila City, Southern Pacific R. R., Arizona..	199	50	Mearns and Holzner, Mar. 1 to 5, 1894.
67	Yuma, Arizona..	206	43	Mearns, Mar. 20 and 21, 1894; Mearns and Holzner, Mar. 5 to 13 and 31 to Apr. 1, 1894.
68	Colorado River bottom, at western edge of Yuma Desert.	201	27	Holzner, Mar. 13 to 31, 1894; Mearns, Mar. 13 to 23 and 30 to 31, 1894.
69	Left bank of the Colorado River..........................	205	26	Frequently visited by Mr. Holzner and Doctor Mearns from Mar. 13 to 31, 1894.
70	Las Carpas, Colorado River bottom, Sonora	....	....	Mearns, Mar. 29 and 30, 1894.
71	Well at a cienega in the Colorado River bottom, 30 miles below the boundary.	....	17?	Mearns, Mar. 23 and 24, 1894.
72	Colonia Diaz, Colorado River, Sonora....................	....	10?	Mearns (sent Indian guide Miguel, to trap), Mar. 29 and 30, 1894.
73	Left bank of the Colorado River, opposite the mouth of Hardy River.	....	5?	Mearns, from Mar. 24 to 29, 1894.
74	Old Fort Yuma, California.................................	206	[c] 63	Mearns, Holzner, and Schoenefeldt, from Apr. 1 to 6, 1894.
75	Cooks Wells, Salton River, Lower California.............	210	28	Mearns, Holzner, and Schoenefeldt, from Apr. 7 to 8, 1894.
76	Seven Wells, Salton River, Lower California.............	213	19	Mearns, Holzner, and Schoenefeldt, from Apr. 8 to 18, 1894.
77	Gardners Laguna, Salton River, Lower California	216	16	Mearns, Holzner, and Schoenefeldt, from Apr. 18 to 27, 1894.
78	Laguna of Salton River, Lower California	218	9	Mearns, Holzner, and Schoenefeldt, from Apr. 27 to 28, 1894.
79	Unlucky Lake, New River, San Diego County, California.	221	−2	Mearns, Holzner, and Schoenefeldt, from Apr. 28 to May 3, 1894.
80	Indian Wells, New River, California......................	222	−6	Mearns and Schoenefeldt, May 3, 1894; Holzner, May 3, 1894, and May 5 to 6, 1894.
81	Laguna Station, New River, San Diego County, California.	222	−9	Mearns, Holzner, and Schoenefeldt, from May 3 to 6, 1894.
82	Signal Mountain, Colorado Desert, Lower California	224	[d] 83	Schoenefeldt, May 5?, 1894.
83	Coyote Well, Colorado Desert, San Diego County, California.	....	100	Mearns, Holzner, and Schoenefeldt, from May 6 to 7, 1894 (left a detachment of three soldiers, with traps, until May 8).

84	Eastern base of the Coast Range Mountains at the first water on the wagon road to San Diego, *via* Mountain Spring.	231	560	Mearns, Holzner, and Schoenefeldt, from May 7 to 9, 1894.
85	Mountain Spring, Coast Range Mountains, San Diego County, California.	231	775	Mearns, Holzner, and Schoenefeldt, from May 9 to 16, 1894. Schoenefeldt remained at Mountain Spring until May 17.
86	West side, near summit of Coast Range, San Diego County, California.	231	950?	Mearns and Holzner, from May 16 to 17, 1894.
87	Jacumba Hot Springs, San Diego County, California	233	860	Mearns, Holzner, and Schoenefeldt, from May 17 to 31, 1894.
88	Ojo, Nachoguero Valley, Lower California..............	238	1,045	Mearns, Holzner, and Schoenefeldt, from May 31 to June 7, 1894.
89	Campo, San Diego County, California........	240	780	Mearns, Holzner, and Schoenefeldt, from June 7 to 8 and 23, 1894.
90	J. M. Gray's Ranch, San Diego County, California.......	240	....	Mearns, Holzner, and Schoenefeldt, from June 8 to 9, 1894.
91	Thomas Cameron's Ranch, San Diego County, California.	240	....	Mearns, Holzner, and Schoenefeldt, from June 21 to 23, 1894.
92	Campbell's Ranch, at Laguna Mountains, San Diego County, California.	240	[e] 1,675	Mearns, Holzner, and Schoenefeldt, from June 9 to 21, 1894.
93	Tecate River, southeast of Tecate Mountain, Lower California.	245	520	Holzner, June 23 to 28, 1894; Mearns and Schoenefeldt, June 23 to 27, 1894. Summit of Tecate Mountain 3,870 feet (aneroid).
94	San Isidro Ranch, Lower California......................	250	....	Holzner, from June 28 to July 3, 1894; Mearns and Schoenefeldt, from June 27 to July 3, 1894.
95	Jamul Creek, at the old date-palm tree, San Diego County, California.	251?	185?	Mearns, Holzner, and Schoenefeldt, from July 3 to 9, 1894.
96	Pacific Ocean, at the mouth of the Tijuana River (left bank), near Monument No. 258.	258	3	Mearns, Holzner, and Schoenefeldt, from July 9 to 20, 1894 (Holzner was discharged July 20).
97	San Diego, California	258	[f] 60	Mearns and Schoenefeldt from July 20 to Aug. 3, Aug. 15 to 22, and Aug. 29 to Sept. 9, 1894.
98	Ocean Beach, near San Diego, California.................	258	20	Mearns, Aug. 17 and 19, 1894; Schoenefeldt, Aug. 17, 1894.
99	La Jolla, San Diego County, California	258	20	Mearns, Aug. 12, 1894.
100	Alpine, San Diego County, California....................	247	693	Mearns and Schoenefeldt, from Aug. 3 to 7 and 14 to 15, 1894.
101	Pine Valley, San Diego County, California	240?	1,280	Mearns and Schoenefeldt, from Aug. 7 to 14, 1894.
102	San Clemente Island, Pacific Ocean.......................	258	....	Anthony, Brandegee, Mearns, and Schoenefeldt, from Aug. 22 to 29, 1894.

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[a] Plain at base.
[b] Summit of mountain 861, meters.
[c] At the old fort.
[d] At monument.
[e] Aneroid.
[f] At Florence Hotel.

MAMMALS OF THE MEXICAN BOUNDARY REGION.

Class MAMMALIA.[a]

MAMMALS.

Mammals are warm-blooded vertebrates that suckle their young. (They are usually covered with hair.)

Subclass EUTHERIA.

Young developed within the uterus from a minute egg which is destitute of food-yolk; milk glands with nipples.

Superorder DIDELPHIA.

Young born when of very small size and incomplete development, never connected to the mother by a placenta; brain small; its corpus callosum rudimentary.

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[a] SUMMARY OF MAMMALS COLLECTED BY THE BIOLOGICAL SECTION OF THE INTERNATIONAL BOUNDARY COMMISSION, UNITED STATES AND MEXICO.

The mammals collected by the writer, separately, and by himself and Holzner, jointly, are numbered consecutively from 1412 (*Peromyscus*, El Paso, Texas, February 3, 1892) to 3829 (*Urocyon littoralis*, San Clemente Island, California, August 28, 1894).

At such times as Mr. Frank X. Holzner was separated from the writer he kept his own register, beginning with No. 759 (*Peromycus*, San Pedro River, Arizona, November 1, 1892), and ending with No. 1605 (*Procyon*, Pacific Ocean, at mouth of Tijuana River, California, July 16, 1894).

Nearly all of the specimens were measured by Doctor Mearns, excepting Nos. 759 to 1119 of Mr. Holzner's collection, which were measured by him.

Mammals collected by Doctor Mearns and by Doctor Mearns and Mr. Holzner	2,418
Mammals collected by Mr. Frank X. Holzner	847
Total	3,265
Sent by Mr. Holzner to the American Museum of Natural History (about)	233
Total sent to the U. S. National Museum by Mearns and Holzner	3,032
Specimens subsequently registered at the U. S. National Museum	15
Doctor Mearns's collection made at Fort Clark, Texas, in 1897–98	111
Louis Mearns's collection made at Fort Clark, Texas, in 1897–98	3
Specmens sent by A. W. Anthony from San Clemente Island	45
Specimens sent by F. X. Holzner from San Diego, June 1, 1895	68
Specimens sent by F. X. Holzner from San Diego, October 1, 1895	55
Specimens collected by Doctor Mearns in Arizona and New Mexico, 1884–1888	652
Shrews (*Notiosorex* and *Sorex*) sent by F. X. Holzner	2

Order MARSUPIALIA.

MARSUPIALS.

Young at birth are usually placed in an abdominal pouch formed by a fold of skin about the milk glands of the mother, where they remain for a considerable time. Reproductive organs of peculiar structure in both sexes, nearly all the parts being double in the female. Brain small, the corpus callosum rudimentary. Heart with two venæ.

Suborder POLYPROTODONTIA.

Incisors numerous, small, subequal. Canines larger than the incisors. Molars with sharp cusps. (*Flower and Lydekker.*)

Family DIDELPHIDÆ.

OPOSSUMS.

Incisors $\frac{5}{4}$. Hind feet with the four outer toes subequal, distinct, and a well-developed opposable hallux.

Genus DIDELPHIS Linnæus (1758).

Didelphis LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 54.

Type.—*Didelphis marsupialis* Linnæus.

Arboreal: feet not webbed.

Dentition.—I., $\frac{5-5}{4-4}$; C., $\frac{1-1}{1-1}$; P., $\frac{3-3}{3-3}$; M., $\frac{4-4}{4-4}$=50.

KEY TO THE SPECIES OF DIDELPHIS FOUND ON THE BOUNDARY LINE.[a]

Tail black for basal third; generally four-fifths the length of head and body or more (tail ratio about 90–95) _____*Didelphis mesamericana texensis* (p. 150).

Tail black only at extreme base; generally less than two-thirds the length of head and body (tail ratio about 70) __________*Didelphis virginiana* (p. 153).

DIDELPHIS MESAMERICANA TEXENSIS (J. A. Allen).

TEXAS OPOSSUM.

Didelphis mesamericana texensis J. A. ALLEN, Bull. Amer. Mus. Nat. Hist., XIV, Art. XI, June 15, 1901, p. 172.

Type-locality.—Brownsville, Cameron County, Texas.

Type-specimen.—Cat. No. $\frac{33133}{45137}$, U.S.N.M.

Geographical distribution.—The coast region of Texas, from Nueces Bay southward, and the Lower Rio Grande Valley, as far up the valley, at least, as Del Rio, Val Verde County. Sporadically northward to San Antonio, at which point *D. m. texensis* occurs with *D. virginiana*, the latter greatly predominating. It doubtless ranges somewhat to the southward of the Rio Grande, but there are no specimens available for examination from between Brownsville and Tampico.

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[a] See Preliminary Study of the North American Opossums of the Genus Didelphis, by Dr. J. A. Allen, Bull. Am. Mus. Nat. Hist., XIV, Art. XI, pp. 149–188, June 15, 1901.

Dichromatic, the black phase, in the material examined, prevailing in the ratio of five to one of the grap phase, as shown by the following record of specimens examined:

Texas: San Antonio, 2, black phase; Rockport, 3—2 in black phase, 1 in gray phase; Corpus Christi, 4 black phase; Nueces Bay, 2, black phase; Alice, 1, black phase; Sycamore Creek, 1, black phase; Del Rio, 2—1 in black phase, 1 in gray phase; Eagle Pass, 1, black phase; Fort Clark, Kinney County, 8—4 black and 4 gray; Brownsville, 6—3 in black phase and 3 in gray phase. Also additional skulls.

Mexico: Matamoros, 1.

Total, 31, and 7 additional skulls. (*J. A. Allen.*)

Description.—Pouch complete. Size large (see tabulated measurements, p. 152); tail long, scaly, prehensile, with basal half black, and apical portion flesh color; ears entirely black; coat consisting of crinkled, wooly underfur mingled with long bristle-like hairs; color dichromatic.

Gray phase.—An outer long coat of white bristly overhair, 60 to 80 mm. long over the middle of the back and on the rump; beneath this is a coat of soft long underfur, white for about two-thirds of its length, the apical portion black, the long white overhair and the black outer zone of the underfur giving a dark grizzled general effect. Cheeks pure white, with generally a whitish spot over each eye, and a whitish area surrounding the base of the ears; whole top of the head and nose dusky brown, varying in intensity in different individuals, with a blackish stripe running from the ear through the eye to the nose. Fore and hind limbs black, including the feet except the nails, which are yellowish white; upper part of the limbs more or less grizzled with long white overhair. Beneath, the pelage consists mainly of the soft underfur, which is much shorter and thinner than on the upper surface, with the tips of the fur more or less tinged with dusky and with a few long bristly overhairs.

Black phase.—Long, bristly overhair black instead of white, beneath which is the usual soft, long underfur, white for its basal two-thirds and tipped with black. In other respects as in the gray phase.

During the breeding season the pouch of the female is lined with fine, crinkled, woolly hairs of a rusty chestnut-brown color. During the nonbreeding period the pouch hairs are often gray or even whitish. (*J. A. Allen.*)

Cranial and dental characters.—The nasals, with individual exceptions, terminate posteriorly in a pointed angle, the portion anterior to the point of greatest expansion being as long as or a little longer than the anterior half of the basal rhomboid. (See tabulated cranial measurements, p. 155.)

Remarks.—Doctor Allen observes: *Didelphis measmericana texensis* differs markedly from *D. virginiana* in the color and markings of the head and in its much longer tail, but presents no notable cranial differences. It differs from *D. marsupialis* in the form of the nasals, in its somewhat longer tail, and in the great predominance of the black phase, the prevailing phase in *D. marsupialis* being gray.

Habits.—This opossum was found only in the region about Fort Clark, Texas, where it was extremely abundant, the gray and black phases being about equally represented. They were especially numerous on Las Moras Creek, where much of my trapping was done, and where it proved an annoyance by invariably getting into traps set for raccoons, armadillos, and other more valuable species. A female taken April 12, 1898, contained young in its marsupium. The range of this species extends west to the Devils River, or, possibly, to the Pecos, beyond which no opossums were heard of. Its Texas range appears to be coincident to that of the Texas persimmon.

When hunting at night along the streams of Texas we sometimes came upon an opossum clinging to the branch of a buttonbush near the water and added it to our night's catch. Once we had a " 'possum dinner " at the officers' club at Fort Clark, and all were agreed that 'possum well cooked tasted good to hungry men.

Measurements of 9 specimens of Didelphis mesamericana texensis.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Caudal vertebræ.	Length of hind-foot.	Ear above crown.
Skin.	Skull.								
				1893.		*mm.*	*mm.*	*mm.*	*mm.*
143138	143138	2242	Fort Clark, Kinney County, Texas.	Jan. 18	♀ im.	730	325	63	49
63130	63130	2243	.....do	....do...	♀ ad.	800	360	69	53
143135	143135	2244	.....do	Jan. 29	♂ im.	710	300	63	48
63131	63131	2246	.....do	Jan. 30	♂ ad.	883	380	76	53
143136	143136	2257	.....do	Feb. 1	♂ ad.	875	400	77	51
63132	63132	2258	.....do	Feb. 2	♂ jur.	645	295	63	45
143139	143139	2259	.....do	....do..	♀ im.	720	340	62	52
63133	63133	2288	.....do	Feb. 10	♂ jur.	675	390	57	44
63134	63134	2301	.....do	Feb. 25	♂ ad.	800	335	63	50

DIDELPHIS VIRGINIANA Kerr.

VIRGINIA OPOSSUM.

Type-locality.—Virginia.

Distribution.—Eastern United States, south to the coast region of Georgia and Gulf States. (*J. A. Allen.*)

Texas: Vernon, 1 skull; Gainesville, 1 skull; Brazos, Palo Pinto County, 2; Kerrville, Kerr County, 1 skull; Mason, 4; San Antonio, 6; Washington County, 1; Matagorda, 1; Deming Station, Matagorda County, 3, and 1 skull; Virginia Point, Matagorda County, 2; Velasco, Brazoria County, 2. (*J. A. Allen.*)

Description.—Size large; nails, tips of toes, and soles of feet flesh color; tail short, clothed for about 2 inches at base with long hair like that of the body, the naked portion brownish flesh color, except at the base, where it is blackish. Ears black, broadly tipped with flesh color, or narrowly edged with this color. The pouch of the female is complete, and usually thickly coated with crinkled wooly hair, usually rufous brown. Pelage of two kinds of hair, an outer long coat of rather coarse white overhair, sufficiently abundant to give tone to the general coloration; beneath this a coat of long, thick, soft wooly underfur about 40 to 50 mm. long on the back, white (sometimes nearly pure snowy white in clean winter specimens, but usually with a slight yellowish cast) for four-fifths of its length, the apical fifth of the long fibers of the underfur being blackish. The long white overhair varies in abundance in different specimens and on different parts of the body, being nearly obsolete on the ventral surface, longer on the back than on the sides, and longest on the lower back and at the base of the tail, where it attains a length of 60 to 80 mm. General color above mixed black and white, the blackish tips of the underfur showing through the long overhair; the white basal portion of the underfur also shows through the blackish surface of the underfur; ventral surface white, with a slight wash of dusky formed by the blackish tips of the hairs. There is generally a large pectoral area in adult males suffused with sulphur yellow, varying from a faint shade of this tint to quite strong greenish yellow, and varying also in respect to the size of the area. This pectoral spot is generally absent in young males, and apparently always absent in the females. The fur over this area is often saturated with an oily, highly odorous secretion from the underlying sebaceous glands, which are probably especially active during the breeding season. There is often a median ventral line of clear white in both males and females, extending from the breast posteriorly, varying in outline and extent in different specimens. Whole head, including the throat and sides of the neck, soiled white or yellowish white, excepting the chin, which is usually darker and like the rest of the ventral surface. The sides of the neck are sometimes strongly tinged with buff. There is also a slight extension forward on the top of the head of the general dusky color of the dorsal surface, which usually forms a V-shaped area, extending to a point midway between the ears and eyes. It is indistinct in outline and varies greatly in intensity and extent in different individuals, being often absent, the head then being practically pure white. Eyes with a very narrow blackish eye ring, widening anteriorly into a small, usually indistinct, preocular spot, sometimes nearly as large as the eye, but often obsolete. Fore and hind limbs black. (*J. A. Allen.*)

Cranial and dental characters.—Posterior border of nasals forming a V-shaped point. (See table of cranial measurements, p. 155.)

Remarks.—We obtained no evidence of the presence of this northern species nearer the International Line than the region surrounding San Antonio, Texas, where it is said to outnumber *Didelphis mesamericana texensis.*

Cranial measurements of 18 specimens of Didelphis mesamericana texensis and D. virginiana.

Collector's number.	Museum number.	Sex and age.	Locality.	Condylo-basal length.[a]	Basilar length.	Occipito-nasal length (occipital crest to front of nasals).	Zygomatic breadth.	Least interorbital breadth.	Palatilar length.	Height of cranium opposite middle of basisphenoid.	Greatest length of nasals.	Length of maxillary tooth row.	Length of mandible.	Length of mandibular tooth row.
			Didelphis mesamericana texensis.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
2246	63131	Male adult	Fort Clark, Kinney County, Texas	130	123	134	69.0	30.2	73.0	37.0	64.5	49.7	109	54.0
2257	....	Male old	....do	119	113	116	65.5	26.0	66.5	36.0	54.5	44.8	98	49.0
2301	63134	Male adult	....do	112	105	111	59.0	22.0	64.0	32.0	53.5	44.0	93	48.0
2293	....	....do	....do	112	105	109	65.0	23.0	62.4	34.0	50.0	44.0	93	48.0
......	1401	Male (?) adult	Matamoros, Mexico	108	101	106	65.0	24.3	61.5	33.0	48.0	42.0	91	46.0
2243	63130	Female adult	Fort Clark, Kinney County, Texas	103	97	104	50.0	20.0	60.0	25.0	49.0	42.0	84	46.5
2242	....	Female, youngish	....do	95	88	92	50.0	19.0	55.0	25.0	45.0	42.5	77	46.5
			Didelphis virginiana.											
......	680	Male (?) adult	Carlisle, Pennsylvania	......	......	118	73.0	26.4	65.0	35.0	54.5	47.0	101	52.0
......	1820	Male (?) old	Chester County, Pennsylvania	......	......	......	......	28.5	72.0	......	63.0	51.0	110	57.0
......	853	Male (?) adult	Virginia	125	118	123	73.0	26.0	70.0	36.5	61.5	50.0	105	55.2
......	15390	....do	Belleville, Illinois	122	115	122	71.0	26.0	70.5	37.0	59.5	47.0	103	52.0
......	8087	Male (?) old	Fort Cobb, Indian Territory	112	105	109	61.0	23.0	62.0	30.0	53.0	45.0	94	49.0
......	35972	Female (?) adult	Montgomery County, Maryland	......	......	99	......	20.0	60.0	27.0	48.0	44.7	84	49.0
......	21080	Female adult	Washington, District of Columbia	112	106	111	62.0	23.0	64.0	31.0	55.0	45.9	95	50.0
......	34768	....do	District of Columbia	96	89	94	......	20.0	57.0	26.0	41.0	41.8	80	46.0
......	808	Female (?) adult	Clark County, Virginia	115	105	114	63.0	25.0	64.0	31.0	55.0	46.0	96	51.3
......	34764	Female adult	Warsaw, Illinois	108	100	107	59.0	21.0	63.0	28.0	53.0	44.0	90	48.0
......	8086	....do	Fort Cobb, Indian Territory	96	88	91	52.5	20.0	56.0	26.0	45.0	41.5	80	46.0

[a] For an explanation of the nomenclature of the cranial length measurements see Thomas, Proc. Biol. Soc. Wash., XVIII, p. 191.

Superorder MONODELPHIA.

Young not born until of considerable size and nearly perfect development, deriving their nourishment before birth from the mother through the intervention of a placenta; a well-developed corpus callosum. (*D. S. Jordan.*)

Order EDENTATA.

The name assigned to this group by Cuvier is often objected to as inappropriate—for although some of the members are edentulous, others have very numerous teeth. If the teeth are not always absent, they invariably exhibit certain imperfections, which are indeed almost the only common characters binding together the various extinct and existing members of the order. These are that they are homodont and, with the remarkable exceptions of *Tatusia* and *Orycteropus*, monophyodont; they are never rooted, but have persistent pulps; except in some fossil forms, they are always deficient in the enamel. (*Flower and Lydekker*, abridged.)

Family DASYPODIDÆ.

ARMADILLOS.

The greater part of the skin strongly ossified. Teeth numerous, simple, of persistent growth, and usually monophyodont, but in one genus (*Tatusia*[=*Tatu*]) a succession of teeth has been observed. Zyogmatic arch of skull complete. Fore feet with strongly developed, curved claws, adapted for digging and scratching—three, four, or five in number. Hind feet plantigrade, with five toes, all provided with nails.

Subfamily TATUINÆ.

This group contains but one genus (*Tatu*). Teeth $\frac{8}{8}$ or $\frac{7}{7}$, very small, subcylindrical. The first and second subcompressed, the last considerably smaller than the others. With the exception of the last, all preceded by two-rooted milk teeth, which are not changed until the animal has nearly attained its full size. Body generally elongated and narrow. Head narrow, with a long, narrow, subcylindrical, obliquely truncated snout. Ears rather large, ovate, and erect, placed close together on the occiput. Carapace with seven to nine distinct movable bands. Tail moderate or long, gradually tapering; its dermal scutes forming very distinct rings for the greater part of its length. Fore feet with four visible toes and a concealed clawless rudiment of the fifth. Claws all long, slightly curved and very slender, the third and fourth subequal and alike, the first and fourth much shorter. Hind feet with five toes, all armed with strong, slightly curved, conical, obtusely pointed nails. The third, longest, then the second and fourth; the first and fifth much shorter than the others.

Genus TATU Blumenbach (1799).

Tatu Blumenbach, Handb. der Naturgesch., 1799, p. 73.

Type.—Dasypus novemcinctus Linnæus.

Characters, those of the subfamily Tatuinæ given above.

This genus differs from all the other armadillos in having a pair of inguinal mammæ, in addition to the usual pectoral pair, and in producing a large number (4 to 10) of young at a birth, all the others having usually but one or two. (*Flower and Lydekker.*)

TATU NOVEMCINCTUM (Linnæus).

TEXAS ARMADILLO.

[*Dasypus*] *novemcinctus* Linnæus, Syst. Nat., 10th ed., I, 1758, p. 51.

[*Tatu*] *novemcinctus*, Blumenbach, Handb. der Naturgesch, 1799, p. 73.

Tatusia novemcinctus, True, Proc. U. S. Nat. Mus., VII (1884), 1885, p. 588.

Tatu novemcinctus, T. S. Palmer, Proc. Biol. Soc., Wash., XI, p. 174, June 9, 1897.

Tatu novemcinctum, Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 11.

Cabassous novem-cinctus, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 4, pl. I (Synop. Mam. N. Am.).

Tatu novemcinctum, Elliot, Field Col. Mus., Zool. Ser., IV, 1904, p. 33, figs. 9, 13 (Mam. Mid. Am.).

Type-locality.—Brazil, South America.

Distribution.—Rio Grande of Texas, west to Devils River, south across Mexico. This species is found on the Mexican border in the Tamaulipan Tropical Tract.

Description.—Dentition: M. $\frac{8-8}{8-8}$ or $\frac{7-7}{7-7}$ = 32 or 28. Shield composed of eight movable scutes in the middle and nine on the sides. Tail as long as body without head; covered by twelve rings, and not enveloped in a cone. Length, 240 mm.; tail vertebræ, 90; hind foot, 30; ear, 20; carapace, 320 by 400. Cephalic shield pale brown; carapace black, with the scutes on the sides yellowish white; tail brownish black, with the anterior half of scutes yellowish white; ears brown; toes yellowish, claws white; skin of head flesh color with a few yellowish hairs.

Habitat and habits.—Armadillos were quite common in the region about Fort Clark, Kinney County, Texas. They burrow in oak mats that grow along water courses. The Seminoles, who esteem them highly as food, hunt them at night with dogs trained for the purpose. Many carapaces were seen nailed to huts of the Seminole Indians.

Order UNGULATA.

HOOFED ANIMALS.

Teeth heterodont and diphyodont. Crowns of molars broad with tuberculated or ridged surfaces. No clavicles. Toes with blunt, broad nails, or in the majority of cases with hoofs, more or less inclosing the ungual phalanges. The testes descend into a scrotum. There is never an os penis. The uterus is bicornuate. The mammæ are usually few and inguinal, or may be numerous and abdominal (as in *Suina*), but are never solely pectoral. The cerebral hemispheres in existing ungulates are well convoluted. (*Flower and Lydekker*, abridged.[a])

Suborder ARTIODACTYLA.

ARTIODACTYLES.

Premolar and molar teeth usually not alike, the former being single and the latter two-lobed. Last lower molar of both first and second dentition almost invariably three-lobed; and the first tooth of the upper cheek series always without a milk-predecessor. Nasal bones not expanded posteriorly. Dorsal and lumbar vertebræ together always nineteen, though the former may vary from twelve to fifteen. Third and fourth digits of both feet almost equally developed. Stomach almost always more or less complex. Colon convoluted. Cæcum small. Mammæ few and inguinal, or numerous and abdominal. (*Flower and Lydekker*, abridged.)

Section SUINA.

PIG-LIKE ARTIODACTYLES.

The existing members of this group are characterized by their bunodont molars and the absence of a complete fusion of the third and fourth metapodials to form a "common bone." The full Eutherian dentition is very frequently present.

The existing swine-like animals may be divided naturally into three families: I. *Hippopotamidæ;* II. *Suidæ*, or true pigs; III. *Dicotylidæ*, or peccaries. (*Flower and Lydekker.*)

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[a] The skeleton of a fossil elephant existed in the Papago well, Pozo Verde, Sonora, Mexico. I obtained fragments of bone and one molar tooth, which were sent to the U. S. National Museum in 1893, and identified by J. M. Gidley as *Elephas colombi* Falcon.

Family TAYASSUIDÆ.[a]

PECCARIES.

Snout as in Suidæ. Dentition: $i\,\frac{2}{3}$, $c\,\frac{1}{1}$, $p\,\frac{3}{3}$, $m\,\frac{3}{3}$; total 38. Incisors rooted; upper canines directed downward, with sharp cutting hinder edges. Toes, four on the fore feet and three on the hind feet (the fifth wanting). Stomach complex. A cæcum. Confined to the New World.[b] (*Flower and Lydekker.*)

Genus TAYASSU Fischer (1814).[c]

Tayassu FISCHER. Zoognosia, III, 1814, p. 284. Type.—*Tayassu pecari* Fischer=*Sus albirostris* Illiger.

Dicotyles G. CUVIER, Règne Animal, I, 1817, p. 237=*Tayassu* Fisher.

Notophorus G. FISCHER, Mém. Soc. Imp. des Nat. de Moscou, V, 1817, p. 418. Replacing *Tayassu*.

The genus *Tayassu*, containing the American pigs, differs from *Sus* and the other Old World genera in having but four upper incisors, and only three premolars on each side above and below, the dental formula being $i\ \frac{2-2}{3-3}$, $c\ \frac{1-1}{1-1}$, $pm\ \frac{3-3}{3-3}$, $m\ \frac{3-3}{3-3}=38$ (fig. 5); their median metacarpal and metatarsal bones are ankylosed into cannon-

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[a] For a plea for the retention of the names Dicotyles and Dicotylidæ, see Gill, Proc. Biol. Soc., Washington, XV, p. 38, March 5, 1902; see also Thomas, idem, pp. 153, 197; also Allen, Bull. Am. Mus. Nat. Hist., XVI, 1902, pp. 162, 167.

[b] Although not indigenous to the region the family Suidæ is represented by feral swine:

SUS SCROFA DOMESTICUS.

FERAL DOMESTIC HOG.

Wild domestic pigs are numerous in many parts of Texas and Mexico, along the Rio Grande, and are particularly abundant and ferocious about the mouth of the Colorado River, in Sonora. If attacked they become dangerous foes. While camped opposite the mouth of Hardy River, at tide water close to the mouth of the Colorado, several large pigs were killed, and their excellent flesh added to our bill of fare. These pigs, descended from Berkshire stock, were black and of extraordinary size. The skull of an adult male, from near the mouth of the Colorado River (No. 60356 U.S.N.M.), measures: Greatest length, 335 mm.; basal length, 342; basilar length (to tip of premaxillary), 292; palatal length to tip of premaxillary, 214; width of palate at first premolar, 51; zygomatic breadth, 169; least interorbital breadth, 81; length of nasals, 168; greatest breadth of both nasals together, 35; occipital depth (to lower rim of foramen magnum), 124.

[c] Elliot, in his Land and Sea Mammals of Middle America and the West Indies (Field Columbian Museum, publication 95, zoological series, IV, Pt. I, 1904, pp. 61–68, fig. XXII and plates XXV–XXVIII), uses the generic name *Tagassu* Frisch (Das Natur-Syst. vierfüss. Thiere, in Tabellen, 3 Tab. Gen., 1775. Type, *Sus tajacu* Linnæus), and uses the family name *Tagassuidæ*. See, however, Thomas and Miller in Ann. and Mag. Nat. Hist., 7th ser., XVI, pp. 461–464, October, 1905.

bones: and an odorous gland occupies the top of the rump. Vertebræ: C 7, D 14, L 5, S 4, C 7.

Professor Cope[a] refers the known species of *Tayassu* "to three subdivisions, which may be at some future time regarded as genera." He places the Brazilian *Sus tajacu* Linnæus in *Notophorus* Gray, and the Texan *Dicotyles angulatus* Cope in *Dicotyles* Cuvier. On the following page he describes what he considers to be intermediate between *Tayassu tajacu* and *T. angulatum*, from Costa Rica, and in conclusion observes: "It appears, then, that the latter [*Tayassu angulatum*] must be regarded as a subspecies [of *Tayassu tajacu*] rather than a species." His subdivisions would, in such a case, have only the value of subspecies instead of genera. On page 134, in his amendment to the definitions he had previously given of the subfamily *Dicotylinæ*, of the family *Hippopotamidæ*, and of the two included genera, *Dicotyles* and *Platygonus*, he says: "That of the subfamily 'Digits three' should be supplemented by the words 'on the anterior foot, and four on the posterior.'" Inadvertently the extra digit was placed on the wrong foot, the digital formula being 4–3 instead of 3–4.

Subgenus TAYASSU Fischer (1814).

Tayassu, Merriam, Proc. Biol. Soc. Wash., XIV, p. 122, July 19, 1901. Restricted to the *tajacu-angulatus* group."

Notophorus Gray, Proc. Zool. Soc., 1868, p. 43. Type and only species, *Sus tajacu* Linnæus. Preoccupied by *Notophorus* Fischer, 1817=*Tayassu* Fischer, 1814.

Tayassu, T. S. Palmer, North American Fauna, No. 23, 1904, p. 955.

Characters.—Smaller than *Olidosus*,[b] with the skull less massive. Sides of rostrum excavated over premolars, and divided into upper and lower parts by continuation of the zygomatic ridge (fig. 4*a*); palate narrowed between canines and molars, with a sharp ridge running from first premolar to inner side of canine. Teeth smaller and relatively narrow anteriorly; second lower molar very much smaller, with anterior cusp high and slender, the posterior cusp nearly obsolete. (Fig. 5*a*.)

TAYASSU ANGULATUM (Cope).

TEXAS PECCARY.

Dicotyles angulatus Cope, American Naturalist, XXIII, No. 266, February, 1889, pp. 146, 147 (original description); March, 1889, pp. 134, 135.

Dicotyles tajacu, Elliot, Field Col. Mus. Zool. Ser., II, 1901, p. 35, pl. XI (Synop. Mam. N. Am.).

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[a] American Naturalist, XXIII, 1889, p. 134.

[b] Subgenus *Olidosus* Merriam, Proc. Biol. Soc., Wash., XIV, July 19, 1902. For "the *albirostris* group" (=*Dicotyles* Gray, Proc. Zool. Soc., 1868, p. 45. Type, *D. labiatus* Cuvier. Preoccupied by *Dicotyles* Cuvier, 1817=*Tayassu* Fischer, 1814).

Tayassu angulatum, MILLER and REHN, Proc. Bost. Soc. N. H., XXX, No. 1, Dec. 27, 1901, p. 12 (Syst. Results Study N. Am. Mam. to close of 1900).

Tayassu angulatum, ELLIOT, Field Col. Mus., Zool. Ser., IV, Pt. I, 1904, p. 63, pls. XXV, XXVI (Mam. Mid. Am.).

Type-specimens.—One from the Guadalupe River, two from the Llano River, and two from a tributary of the Red River, Texas.

Geographical range.—Tropical and Sonoran zones of the Texan and Tamaulipan regions.

Description.—Form, pig-like. Tail, abortive. Toes, 4–3. A large scent gland occupies the upper part of the rump. Color above black, mixed with soiled grayish white annulations to the bristles. An erectile mane of long black bristles extends from the occiput to the scent gland on the rump: and an incomplete whitish "collar" crosses the hind part of the neck, extending obliquely upward and backward from in front of the shoulder to the black mane on the back. The ears are blackish externally and grayish internally where the long hairs are arranged in five separate lines, which are narrow at base, broadening towards the tip, which they fail to reach. The muzzle, cheeks, and under side of head are lighter in color than the back, having a large admixture of brownish gray annuli to the bristles. The under surface is reddish black mesially, this color fading to brownish gray on the axillæ and hollows of thighs. The limbs are blackish at the hoofs (fig. 3), becoming paler above as the light rings of the bristles increase in width.

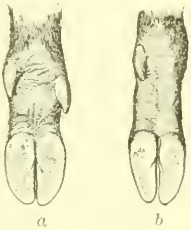

FIG. 3.—TAYASSU ANGULATUM. *a*, RIGHT FORE-FOOT; *b*, RIGHT HIND-FOOT.

The young when newly born are plain yellowish gray on limbs and under parts; above, brownish yellow mixed with black, with a black vertebral stripe extending from the occiput to the gland on the rump; tip of ear dusky. Sometimes the shade of coloring is decidedly reddish in young peccaries. In growing older the black vertebral stripe grows less conspicuous, as black gradually becomes the predominant color of the upper surface; but the collar and pale annuli do not lose their reddish shade until the animal has nearly grown to mature size.

Cranial and dental characters.—From *Tayassu tajacu* (Linnæus) it differs in having the molar crests continued forward to base of canine alveolus instead of terminatng above the infraorbital foramen; nasal bones pinched or angulate on the middle line instead of rounded in cross section; first (fourth of the old works) superior premolar quadritubercular, with intermediate tubercles, and quadrate in outline, molariform instead of tritubercular or rounded in outline, premolariform; molars wrinkled in *angulatum*, not so in *tajacu*.

Habits and habitat.—Though greatly reduced in number, peccaries are still common in southwestern Texas. They prefer rocky walls of canyons and the vicinity of streams or hilltops where caverns and hollows afford protection, to which they retire during midday. On Las Moras Creek, in Kinney County, Texas, they often join herds of domestic swine, feeding on roots, acorns, and pecan nuts in company with the half-wild pigs known as "razor-backs."

TAYASSU ANGULATUM SONORIENSE (Mearns).

YAQUI PECCARY.

Dicotyles angulatus sonoriensis Mearns, Proc. U. S. Nat. Mus., XX, Dec. 24, 1897, pp. 469, 470 (pp. 3, 4 of the advance sheet issued Feb. 11, 1897; original description).

Tayassu angulatum sonoriense, Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 12 (Syst. Results Study N. Am. Mammals to close of 1900).

[*Tayassu angulatum*] *sonoriense*, Elliot, Field Col. Mus., Zool. Ser., IV, Pt. 1, 1904, p. 64 (Mam. Mid. Am.).

Type-locality. San Bernardino River, Sonora, near Monument No. 77. (Type, skin and skull, No. $\frac{20657}{35814}$, U. S. National Museum.)

Geographical range.—Inhabits the Yaqui River basin of northwestern Mexico and adjacent interior region of the United States west of Texas, ranging from sea level on the Gulf of California to the boreal summits of the mountains.

Description.—The type, an old male, has the coloration paler than that of the Texas peccary, *Tayassu angulatum* (Cope). Above there is a mane of long, black-tipped bristles, the longest measuring 135 mm. in length, extending from the crown to the naked gland on the rump, and producing by contrast a sharply black dorsal band. The rest of the upper surface is a pepper-and-salt mixture of commingled grayish white, yellowish white, and brownish black colors, the bristles being whitish, ringed and pointed with brownish black. On the flanks there is most whitish, while the shoulders are blackest where the so-called "collar," a narrow band of buffy white, extends across the side, behind the neck and in front of the shoulder, and is bordered by blackish on either side. The muzzle, cheeks, and space in front of the eye are brownish gray, annulated with darker. There is a brownish white orbital area, and a spot of brown (glandular) staining below the front of the eye. The under jaw is yellowish, with a triangular blackish patch near the end of the chin. Ears with outer (convex) surface and tip heavily coated with black bristles; concavity with five bands of long, buffy, white hairs. (Fig. 7.) Legs mixed brownish white and brownish black, becoming solid black about the hoofs, and with a light band encircling the foreleg above the accessory hoofs. Under surface of body with a blackish median area, which fades to grayish on the axillary and inguinal regions. Snout livid plumbeous, sometimes flesh color around the nostrils. Hoofs plumbeous black.

Another adult male (No. 20656, U.S.N.M., mounted), killed at the same time and place, is almost exactly like the type in coloration. An old female (No. $\frac{20658}{35815}$, U.S.N.M.) which was shot by the writer at Cajon Bonito Creek, Mexico, near the boundary between Chihuahua and Sonora, and about 6 miles south of the United States border, August 11, 1892, is a little paler and more reddish, as is also a skin obtained in Guadalupe Canyon, Arizona.

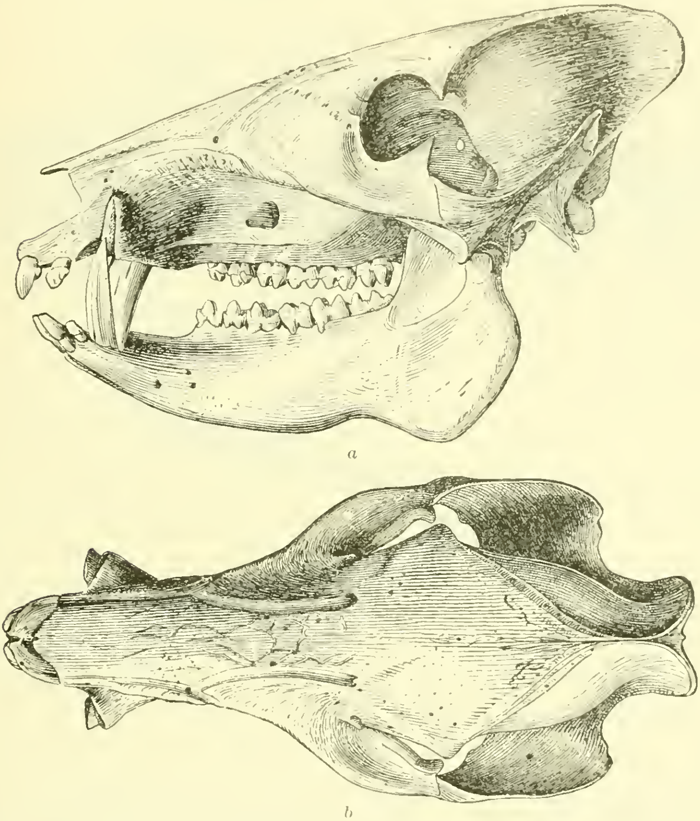

FIG. 1.—TAYASSU ANGULATUM SONORIENSE. (Cat. No. 35815, U.S.N.M.) *a*, SKULL, LATERAL VIEW; *b*, DORSAL VIEW.

At the Mexican town of Santa Cruz, on the river bearing the same name, a young female was purchased from a Mexican boy in October, 1893, and sent alive to the National Zoological Park in Washington City, where it died during the following winter and is now in the collection of the U. S. National Museum (No. 58986, skin and skull). This specimen resembles the palest form of the peccary, from the desert region bordering the Gulf of California, of which I have examined a skin obtained from the Seri Indians by Mr. William Dinwiddie, of the Bureau of Ethnology, Smithsonian Institution. From him I learned that this species ranges to the Gulf of California, as I had been previously told by Don Cypriano Ortego, who resides at Santo Domingo, Sonora, the most western point at which we found peccaries on the Mexican Boundary Line. The Santa Cruz specimen is gray, without red tints, nearly white below, and with the vertebral line less black than usual.[a]

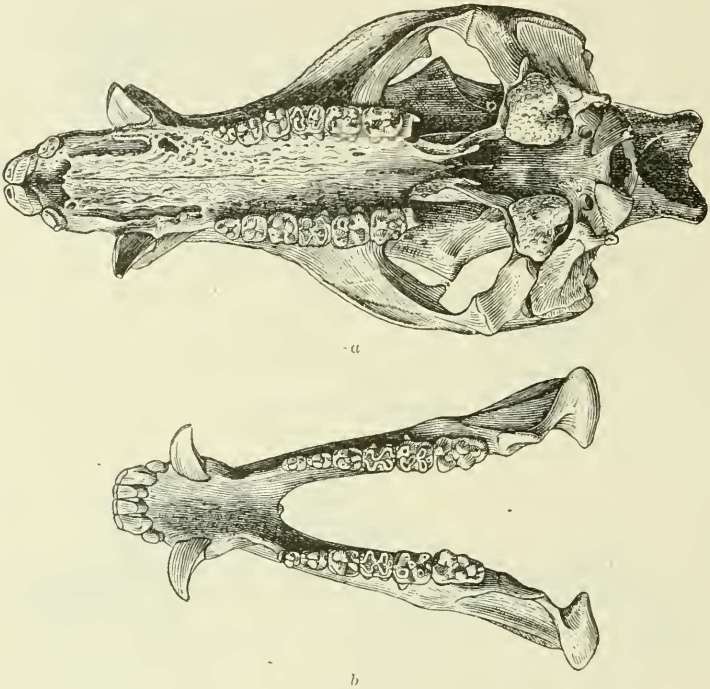

FIG. 5.—TAYASSU ANGULATUM SONORIENSE. (Cat. No. 35815, U.S.N.M.) *a*, SKULL, VENTRAL VIEW; *b*, LOWER JAW, SEEN FROM ABOVE.

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[a] Since the above was written a subspecies *humeralis* (properly *humerale*) has been described by Doctor Merriam, as follows:

TAYASSU ANGULATUS HUMERALIS Merriam.

Type from Armeria, Colim. No. 45243, ♀ ad., U. S. National Museum, Biological Survey Collection. February 26, 1892. E. W. Nelson and E. A. Goldman. Original No. 1945.

Characters.—Similar to *angulatus*, but sides grayer; head yellower; dorsal black band more strongly marked, almost as sharply as in *sonoriensis* from Arizona, shoulder stripes yellowish ochraceous, broad and conspicuous, as

The peccary of the lower Rio Grande and of eastern Mexico is a smaller animal, having relatively small ears and feet (fig. 8) and a blacker coloration. The coat is more dense and the bristles less coarse, rigid, and crinkled than in the form here described. The Texas peccary is blackish, whereas the peccary of Arizona and Sonora is grayish, with a black dorsal stripe.

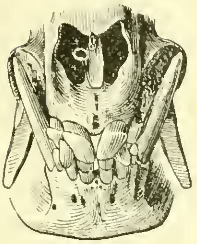
FIG. 6.—TAYASSU ANGULATUM SONORIENSE. SKULL, FRONT VIEW. (Cat. No. 35815, U.S.N.M.)

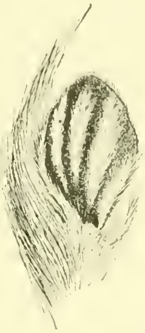
FIG. 7.—TAYASSU ANGULATUM SONORIENSE. INNER SURFACE OF EAR. (Cat. No 20656 U.S.N.M.)

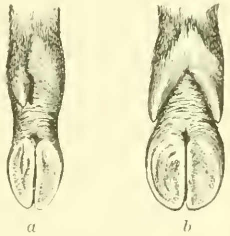

FIG. 8.—TAYASSU ANGULATUM SONORIENSE. (Cat. No. 20657, U.S.N.M.) *a*, RIGHT HINDFOOT. *b*, RIGHT FOREFOOT.

A young specimen was seen alive, having been caught by a Mexican ranchman on Cajon Bonito Creek, Sonora, August 25, 1892, at which time it was about as large as the eastern cottontail. Color, above reddish brown, with a black vertebral area, beginning anteriorly as a black spot on the nape, extending thence in a line backward and again broadening on the lumbar region, where it bifurcates before terminating. Upper surface thickly sprinkled with black hairs except in the area occupied by the "collar." Under parts and limbs

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strongly marked as in *yucatanensis*, but yellowish fulvous instead of white. Skull of male similar to that of male *angulatus;* skull of female decidedly larger, with longer tooth row. In skulls young enough to show the sutures the nasal bones are strongly convex posteriorly, long and slender, and only slightly broader between maxillæ than between premaxillæ (differing markedly from their condition in *angulatus*, in which they are very much broader between the maxillæ); and the ascending or nasal arm of premaxilla is decidedly longer than in *angulatus*.

Remarks.—Compared with *sonoriensis* of Arizona, the sides are less gray, the dorsal band less sharply defined, the shoulder stripes yellower and much more strongly marked. The sexual disparity in size is greater than in *sonoriensis*, the female being considerably larger than the male.

Measurements.—Type (♀ ad.): Total length 960, tail 60, hind foot 215. *Skull:* Basal length 203, occipitonasal length 224, zygomatic breadth 108, greatest breadth across squamosals posteriorly 99, palatal length 151; length of upper molariform series 67. (*C. Hart Merriam*, Proc. Biol. Soc. Washington, XIV, 1901, p. 122.

reddish or yellowish brown (prairie-dog color) without any intermingling of black, but becoming black in a small area next to the hoofs.

Young about the same size were afterwards seen at Pozo de Luis, in northwestern Sonora, in January, 1893, which were of a pale buff or clay color, with a less distinct vertebral black stripe.

Cranial and dental characters.—The lateral dentition seems to be simpler and lighter than in *Tayassu angulatum* (typical). The premolars are usually quadritubercular with one of the inner tubercles often obsolete. The posterior molar is smaller and less roughened by needle-like subsidiary tubercles. The skull itself is slightly broader than that of *T. angulatum.* (See figs. 4, 5, and 6.)

Measurements of three specimens of Tayassu angulatum sonoriense.

Museum number. Skin.	Museum number. Skull.	Original number.	Locality.	Date.	Sex and age.	Total length.	Caudal vertebræ.	Tail to end of hairs.	Ear, height above crown.	Ear, height above notch.	Ear, greatest width.	Length of hindfoot.	Length of head.
				1892.		*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*
20658	35815	2056	Cajon Bonito Creek, Sonora, Mexico, near Mexican boundary line.	Aug. 11	♀ ad.	951	65	90	130	100	85	210	295
[a]20657	35814	2099	San Bernardino River, Sonora, Mexico, near Monument No. 77, Mexican boundary line.	Sept. 8	♂ ad.	920	65	128	115	95	88	200	300
[b]20656	......	2100	..do	(c)	♀ ad.	940	67	116	102	91	100	204	285

[a] Type.

[b] Mounted.

[c] Sent alive to Washington.

Life history.—Skins of peccaries killed in the Apache Mountains near Monument No. 40, Mexican Boundary Line, were the first unmistakable evidence seen of the existence of these animals as we proceeded westward from the Rio Grande. Specimens were subsequently taken in the San Luis, Guadalupe, and Santa Cruz mountains, and in the valley of the San Bernardino River. On the San Luis Mountains they were found from the lower edge of timber up to the highest summits, as well as on those parts of the surrounding plains and playas where the nolinas, mesquites, and mimosas grew abundantly.

We found evidences of the former presence of peccaries in the Huachuca Mountains, Arizona, where soldiers under the command of Capt. Louis A. Craig killed some of them a few years before. Specimens were seen in 1892 in the collection of Col. R. F. Hafford, at Tombstone, Arizona.

Maj. E. K. Otey, of Prescott, Arizona, found peccaries in the Mule Mountains of southern Arizona; and General Crook found them in Tonto Basin, where the writer saw their tracks as far north as Pine and Fossil creeks in Central Arizona. On the Mexican Boundary Line the species was found by us as far west as the Sonoyta Valley, near the Mexican town of Santo Domingo, between which point and the Pacific Ocean no trace of it was seen, although it reaches the Gulf of California farther south in the strip of country named Seriland by Dr. W J McGee.

The late Maj. Charles E. Bendire shot peccaries during the period from 1857 to 1859 near the spot where Lieutenant Cushing, of the Third Cavalry, was killed by Indians in the Whetstone Mountains of Arizona, and also in the Chiricahua Mountains, and near the old mission of San Xavier, in the Santa Cruz Valley. At the latter place the major witnessed an amusing incident—the treeing of a negro servant by a band of infuriated peccaries. Although stories of similar occurrences are commonly repeated by the white settlers of the Southwest, this is the only instance of an attack made on man by peccaries that has come to me on unimpeachable authority. I have met with bands of peccaries on a few occasions, when some of them were shot. They were always wild and shy, exerting themselves to the utmost to escape, and paying no attention to the unfortunate ones that were killed or wounded. In one instance, when hunting in the Cobota Mountains, Sonora, in company with Lieut. William H. Bean, of the Second Cavalry, I wounded a female peccary standing in the midst of a drove of them, with her young beside her. Although she squealed loudly, the remainder of the band rushed off and left her. A moment later we came upon her among the bushes and cacti, but she arose and escaped from us without attempting to defend her young, which were no larger than cotton-tail rabbits.

Although signs of peccaries were abundant in an extensive area of oak scrub (*Quercus emoryi*) around Monument No. 64, at timber line of the east base of the San Luis Mountains, the creatures were so clever at hiding that none could be seen, although we frequently came so near them that their peculiar odor was very evident. On Silver Creek, in southeastern Arizona, these animals are periodically abundant, and many have been killed by hunting parties from the old post (now abandoned) of Fort Bowie. I have known expert cowboys to ride them down, lasso and tie them, and so bring them alive to camp. It is only by accident that they are discovered in their retreats during the middle of the day; but at morning and evening herds of them may be seen feeding in the open. They are really pretty beasts, and make nice, gentle pets when taken young. They are swift runners, though easily overtaken by a horse. The sexes are practically of the same size, an adult male and female, taken from the same herd on the San Bernardino River, weighing, respectively, 46 and 44 pounds avoirdupois.

Peccaries abound in the Pajarito Mountains and at La Osa, Pima County, Arizona. At the La Osa ranch Mrs. W. S. Sturges had several as pets that had been presented when very young by Papago Indians whom she had befriended. They become gentle and affectionate, if not maltreated, but exceedingly vicious if teased and hurt. One that I bought from a Mexican lad was fondled and kissed by its owner, who parted from it with tears. It followed us about in the camps, where, from its habit of rubbing against one, it received several hard kicks from frightened teamsters at night, which wrought such a change in its previously friendly disposition that no one could safely approach it, on which account I was obliged to send it to the National Zoological Park, where it became tractable.

On the whole, peccaries were not abundant on the boundary strip. Whenever any were killed they were eaten as a novelty and usually considered good meat. They are cleanly animals, but, on account of their musk glands, require careful dressing for the table.

They were abundant at Pozo de Luis, Sonora, where they usually frequented rocky hills. Their tracks and wallows were seen everywhere about the base of the mountains. When hunting with Lieut. William H. Bean in December, 1893, we surprised a small herd of peccaries that was wallowing among some prickly-pear cacti in a ravine at the foot of the Sierra del Cobota, Sonora. All but one ran rapidly over a ridge and disappeared; but that one stood still, behind a bush, and was shot. I then ran to the summit of the ridge in the expectation of obtaining a view of the retreating herd, and in doing so almost ran over the wounded peccary, which I saw had its foreleg shot through close to the body. With a grunt the wounded animal dashed down a hillside through cacti and shubbery so thick that I was unable to get another glimpse of it. Following up the herd, Lieutenant Bean and I obtained several more shots at the fleeing peccaries. all of which escaped by hiding in caves and among piles of rocks composing the talus at the base of a cliff. A little later I returned alone to the spot where the peccary had been wounded, and my attention was attracted to a crying suckling, which I at length descried among the large joints of a prickly pear, looking very much distressed over its sudden abandonment. It was a wee thing of a reddish color, quite different from its parents. Supposing I might be able to catch it alive, I stooped and made the attempt, whereupon the tiny pig squealed and vanished so swiftly that I could not attempt to shoot it. Later Lieutenant Bean joined in a search, and we were rewarded by finding the little beast, which was espied running along an open space on a neighboring ridge. Seeing where it tried to hide, I chased it up and fired at it several times with my rifle; but it darted so nimbly through the dense growth that it was unhurt, although it collided with my comrade, who also vainly tried to either shoot or overtake it. I visited the spot the next day, but saw no peccaries. We next found abundant signs of them on the Nariz Mountains to the westward. When questioning Mexicans at Gila City, Arizona, as to whether there were peccaries in that vicinity, one of the men told me he had killed them on a hill near where the Boundary Line reaches the Colorado River; but we saw none on the Colorado or west of Santo Domingo, Sonora, where one had been seen in December, 1893. Señor Don Cypriano Ortego saw a peccary at one of his ranches, 3 miles south of Santo Domingo, about January 5, 1894. He informed me of their abundance in a high range northeast of Sonoyta.

Maj. John G. Bourke's instructive book, entitled On the Border with Crook, contains several allusions to the peccary as an inhabitant of Arizona and Sonora. General Crook found them in various parts of southern Arizona, as well as at the type locality in Sonora, for Bourke observes (p. 473):

> The next morning [January, 1886] we struck out southeast [from San Bernardino Springs, Monument No. 77] across a country full of little hills of drift and conglomerate, passing the canyons of the Guadalupe and the Bonito, the former dry, the latter flowing water. A drove of the wild hogs (peccaries or musk hogs, called "jabali" by the Mexicans) ran across the path; instantly the scouts took after them at a full run, "Ka-e-ten-na" shooting one through the head while his horse was going at full speed, and the others securing four or five more; they were not eaten.

Again Bourke writes (p. 137):

> Our line of travel lay due east 110 miles to old Fort Bowie, thence north through the mountains to Camp Apache, thence across an unmapped region over and at the base of the great Mogollon Range to Camp Verde and Prescott, on the west. In all, some 675 miles were traveled. Our commanding general [George Crook] showed himself to be a man who took the deepest interest in everything we had to tell, whether it was of peccaries chased off on one side of the road, etc.

From General Crook I also ascertained that they were inhabitants of the whole San Pedro Valley, Arizona and Sonora.

Family CERVIDÆ.[a]

DEER.

Frontal appendages, when present, in the form of antlers. First molar, at least, in both jaws brachydont. Two orifices to the lachrymal duct, situated on or inside the rim of the orbit. An antorbital or lachrymal vacuity of such dimensions as to exclude the lachrymal bone from articulation with the nasal. Upper canines usually present in both sexes, and sometimes attaining a very great size in the male. Lateral digits of both fore and hind feet almost always present, and frequently the distal ends of the metapodials. Placenta with few cotyledons. Gall bladder absent (except in *Moschus*). (*Flower*, Encyc. Brit., Ninth ed., XV., p. 432.)

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[a] In the year 1856 a drove of 75 Arabian camels (*Camelus dromedarius*) was procured from Smyrna by the United States Government and distributed over Texas, Arizona, and New Mexico. During the civil war the whole of these animals fell into the hands of the Confederates, and were used for carrying the mails, some of them making journeys of upward of 120 miles in a day. At

Subfamily CERVINÆ.

Horns deciduous, solid, developed from the frontal bone, more or less branched, covered at first by a soft, hairy integument, known as "velvet;" when the horns attain their full size, which they do in a very short time, there arises at the base of each a ring of tubercles, known as the "burr;" this compresses and finally obliterates the blood vessels supplying the velvet, which dries up and is stripped off, leaving the bone hard and insensible; the horns or "antlers" are shed annually, the separation of the "beam" from its "pedicel" taking place just below the burr; antlers are [normally] wanting in the female (excepting in the reindeer), but they are present in the male of nearly all species. Stomach in four divisions, of the ordinary ruminant pattern. Dental formula, *i.* $\frac{0-0}{3-3}$; *c.* (usually) $\frac{0-0}{1-1}$; *pm.* $\frac{3-3}{3-3}$; *m.* $\frac{3-3}{3-3}$. (*Jordan.*)

Genus ODOCOILEUS Rafinesque (1832).

Odocoileus RAFINESQUE, Atlantic Journal, I, p. 109. Autumn of 1832.

Type.—*Odocoileus speleus* RAFINESQUE=*Cervus dama americanus* ERXLEBEN, or a closely related subfossil form.

For the use of this name in place of *Cariacus* (LESSON, Nouv. Tabl. Règne Animal, 1842, p. 173) and *Dorcelaphus* (GLOGER, Hand.-u. Hilfsb. der Naturgesch., 1841, pp. XXXIII, 140), see MERRIAM, Proc. Biol. Soc. Wash., XII, p. 99, April 30, 1898.

Regarded by Lydekker (The Deer of All Lands, 1898, p. 243), as forming part of the genus *Mazama*.

Characters.—Horns small, curving forward, the first snag short, at some distance above the base, and like the others curving upward;

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the conclusion of the war the remnant of these useful beasts once more came under the Government of the United States, and others were purchased in 1866. These were distributed through Arizona and Texas for breeding purposes; but many died, and the experiment proved unsatisfactory. Consequently those that survived were turned adrift to shift for themselves. During the period occupied by the Boundary Survey some camels were known to exist, most of them north of the Gila River, in southwest Arizona. We saw a skeleton of one on the Tule Desert, but no living camel. [For an account of the introduction of camels and dromedaries into Texas, see Attwater, Bull. Am. Mus. Nat. Hist., VI, 1894, p. 184.]

tail rather long; hoofs rather elongate. Skull with the vomer dividing the posterior nares into two distinct chambers. Lachrymal vacuity very large, and lachrymal fossa small. Auditory bullæ slightly inflated. Dentition. — I $\frac{0-0}{3-3}$; C $\frac{0-0}{1-1}$; Pm $\frac{3-3}{3-3}$; M $\frac{3-3}{3-3}$=32. Vertebræ: C 7, D 13, L 6, S 4, Ca (about) 13. Tail long or short. Color uniform in adult.

KEY TO THE MEXICAN BOUNDARY FORMS OF ODOCOILEUS.

a. Size large; lachrymal fossa deep, forming a pit; horns dichotomous; metatarsal gland elongate; tail composed of about 9 short vertebræ, naked at base below.
  b. Tail short, compressed at base and expanded into a heavy terminal brush, naked below for more than half its length; metatarsal gland greatly elongated.
    c. Upper side of tail with a median black stripe; color dark and very red in summer__________________*Odocoileus hemionus californicus* (p. 211).
    cc. Upper side of tail all white at middle; color pale and less red in summer.
      d. Size large; color pale; beam of horn long and stout, and horns very divergent__________________*Odocoileus hemionus eremicus* (p. 208).
      dd. Smaller; color darker; horns less stout, more erect, and branched, and with a shorter beam______*Odocoileus hemionus canus* (p. 191).
  bb. Tail longer, flattened and tapering throughout, black above, white below, naked only at extreme base; metatarsal gland much shorter. *Odocoileus crooki* (p. 185).
aa. Size smaller; lachrymal fossa shallow, not forming a pit; horns not dichotomous; metatarsal gland extremely short; tail of about 11 elongated vertebræ, hairy to base below.
    c. Larger, adult male measuring 1,585 mm. in total length; color moderately pale; ears shorter, measuring 160 mm. from crown, with black edges and tips; dentition heavy_*Odocoileus texanus* (p. 171).
    cc. Smaller; total length averaging 1,454 mm. in five adult males; color extremely pale; ears longer, averaging 192 mm. from crown, without black edges and tips; dentition weaker. *Odocoileus couesi* (p. 175).

ODOCOILEUS TEXANUS (Mearns).[a]

TEXAS WHITE-TAILED DEER.

Dorcelaphus texanus MEARNS, Proc. Biol. Soc. Wash., XII, 1898, p. 23, January 27, 1898 (original description).

Odocoileus texanus, THOMPSON, Forest and Stream, LI, 1898, p. 286, October 8, 1898.

Odocoileus texensis, MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, 1901, p. 17 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Odocoileus americanus*] *texensis*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 40 (Synop. Mam. N. Am.).

[*Odocoileus americanus*] *texensis*, ELLIOT, Field Col. Mus., Zool. Ser., IV, Pt. 1, 1904, p. 70, pls. XXXIX, XXX (Mam. Mid. Am.).

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[a] An illustration (fig. 9), showing a skull and audital region of *Odocoileus americanus*, is introduced for purposes of comparison.

Type-locality.—Fort Clark, Kinney County, Texas. (Type, skull and skin, No. 84794, U.S.N.M.)

Geographical range.—Inhabits the Rio Grande region of Texas, extending south through Mexico as far as San Luis Potosi.

General characters.—Size small; ears relatively small, with black on edges and tip; horns small and strongly incurved; limbs relatively short; molar and premolar teeth very large; general color pale; coat fine and long.

Color.—In the type, which is in complete winter coat, the upper surface is superficially a pepper-and-salt mixture of black, yellowish white, and gray. A distinctly blackish area begins anteriorly on the crown, between the horns and ears, and extends posteriorly almost to the root of the tail. The color gradually pales to light yellowish ash on the sides. All of the hairs of the upper surface are white at extreme base, plumbeous ash in the middle, black apically, and subterminally ringed with yellowish white, these whitish annuli increasing in width from the vertebral area downward. Under surface pure white on the axillæ, inner surface of thighs, and abdomen; fuliginous on the chest. Tail white below, black above, the black of the upper surface much obscured by broad yellowish brown subterminal annuli to the hairs. Head, with naked nose-pad, and front of under lip, plumbeous black. Iris yellowish hazel. Upper jaw white anteriorly, next to the naked muffle, becoming light ash farther back, with an intervening area of black, which latter forms a triangular area, with its base applied to the posterior margin of the nostril and its apex crossing the middle of the upper lip and extending over the under jaw to form a small black spot behind the pure white chin. Throat white, mixed with ash where the basal coloring of the hair is exposed, between the white tips. Upper side of head black, much obscured on the forehead by dirty white and reddish subterminal annuli. Orbits and base of ear externally whitish. Concavity of ear densely clothed with long white hair; convexity tipped and bordered by black, except at base anteriorly, the black inclosing an area of pepper-and-salt gray; base of ear posteriorly clear ash gray.

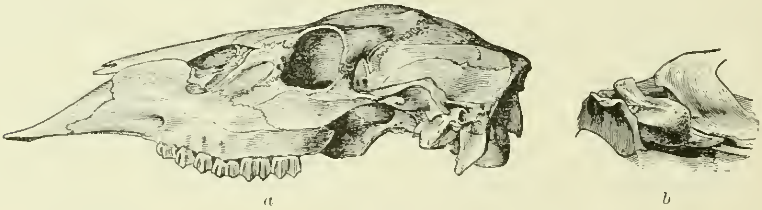

Fig. 9.—Odocoileus americanus. (Cat. No. 912, U.S.N.M., Virginia.) *a*, Skull; *b*, audital region

Sides of head ash gray, thickly annulated with whitish. Brows and bristles about eyes all black; those about muzzle black and white. Limbs reddish fawn, more or less mixed with gray and black anteriorly, whitish or pale fawn color posteriorly, and white around hoofs and between toes. Hoofs plumbeous, horn color where worn off at apex. The metatarsal gland, which measures 15 mm. in length, is surrounded by a tuft of reversed hair, which is white in the middle, bordered by dark brown.

A young male, an old female, and a young female (Nos. 4289, 4290, and 4291, Mearns's collection) killed with the type December 25, 1897, and also in full winter pelage, agree essentially in coloration with the adult male described above, except that the ears and crown of head are blacker, and the light annulations on the upper side of the tail nearly or quite wanting, leaving that part clear black.

The summer coat, as usual, is reddish.

Horns.—The horns of the type approach those of the Sonora deer, *Odocoileus couesi* (Coues and Yarrow), in size and form. There are two basal snags, one directed upward and backward (length 75 mm.) and one forward (length 37 mm.), with four additional points to each horn, making twelve points in all. The length of the beam, measured to end of anterior point, following the curves of the horn, is 440 mm. The horns are symmetrical, their longest points measuring 175 mm. in height. The beam is strongly curved upward, forward, and inward, the tips of the anterior tines approaching within 70 mm. of each other. The total expanse of the horns is 330 mm.; the circumference of beam, at base, 80 mm.

Measurements of type.—Length, measured from end of muzzle to end of last caudal vertebra, 1,585 mm.; tail vertebræ, 265 (to end of hairs, 345); ear from crown, 160; ear from base of opening, 140; girth of chest, 800; from tip of nose to angle of mouth, 90; to eye, 152; to center of pupil, 170; to base of ear, 225; to base of horn, 220; to occiput, 280; diameter of eye, 26; fore limb, from coracoid process of scapula to end of hoof, 700; from olecranon, 575; length of manus, 325; hind limb, from kneejoint to end of hoof, 625; length of pes, 430; height of animal at shoulder, 880; height at hips, 900; from great trochanter to coracoid, 710.

Cranial characters.—The skull in *O. texanus* is narrow, with elongate nasals. That of the type, an old male in which the permanent premolars are considerably worn, presents the following measurements: Basilar length (basion to front of premaxillary), 244 mm.; zygomatic breadth (across middle of orbits), 114; occipito-nasal length, 208; least interorbital breadth, 71; greatest length of nasals, 81; greatest breadth of nasals, 31; least breadth of nasals, 18.5; greatest diameter of orbit, 38; length of upper lateral tooth-row, 24.

The skull of an old female (No. 4290, Mearns's collection) presents these dimensions: Basilar length, 241 mm.; zygomatic breadth, 96; greatest length of nasals, 81; greatest breadth of nasals, 26; greatest diameter of orbit, 35. In the type specimen the nasal and premaxillary bones are separated by a space of 10 mm., which is occupied by a forward arm of the maxillary. In a young male (No. 4289, author's collection), having three points and a basal snag to each horn, the nasal and premaxillary bones barely meet. In an old female (No. 4290, Mearns's collection) and a yearling female (No. 4291, Mearns's collection) the premaxillaries articulate broadly with the nasals.

Remarks.—Numerous skins of this deer from Texas, and Mexico south to San Luis Potosi, have been examined and found to agree in size and coloration with those above described. The horns vary within ordinary limits; but those of the type represent the usual size and form, except that there is more often but one basal snag. The bucks weigh in the neighborhood of 100 pounds and the does about 75 pounds.

While the Texas deer differs sufficiently from the white-tailed deer of southern Mexico and Central America, as well as from the forms recognized in the United States, to warrant its separation, the available material is insufficient to furnish a reliable indication as to its intergradation with them. Therefore, for the present, it is proper to regard it as a species.

Habitat and habits.—This deer, which the Mexicans call "Cuervo" (*Cacalote*), is abundant in the bottom lands and low mountain ranges of southern Texas. In the Santa Rosa range, west of Eagle Pass, it is especially abundant. The Seminoles kill great numbers of them annually, but still the species is found everywhere in abundance throughout its range. Hunters assert, however, that it has modified its habits during recent years. Instead of wandering freely about during the day it is said to hide in the most inaccessible places during the day and to feed during the morning and evening hours or at night. A large number were killed by hunting parties sent out from Fort Clark, Texas, but a notable decrease in abundance was noted. In the valley of Devils River it still bands together in great herds. I saw none of them west of Pecos River.

I have made no critical comparisons of the deer of Indian Territory, but find among my notes the following:

> Daylight found us halfway across Indian Territory. Judging from the appearance of the railway platforms, cotton and deerskins must be the principal exports. * * * Several bales of deerskins were examined and were found to closely resemble the deer of Virginia.

ODOCOILEUS COUESI (Coues and Yarrow).

SONORA WHITE-TAILED DEER.

Cervus mexicanus, Baird, Mam. N. Am., 1857, pp. 653-655, pl. xxiv, fig. 2 (feet). (Excluding synonyms; not of Gmelin.)

Cariacus virginianus var., Coues and Yarrow, Wheeler Surv., V, Zool., 1875, p. 72.

"*Cariacus virginianus* var. *couesi*, Rothrock MSS." Coues and Yarrow, Wheeler Surv., V, Zool., 1875, p. 72, and, by implication in text, p. 75.

Dorcelaphus couesi, Allen, Bull. Am. Mus. Nat. Hist., VII, Art. VI, June 29, 1895, pp. 200, 201 (establishes the species and gives a diagnosis based on six specimens from the Santa Cruz Mountains, Sonora, Mexico, killed in February).

Odocoileus couesi, Thompson (i. e., Seton), Forest and Stream, LI, Oct. 8, 1898, p. 286. Miller and Rehn, Proc. Bost. Soc. N. H., XXX, No. 1, Dec. 27, 1901, p. 15 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Odocoileus americanus*] *couesi*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 40 (Synop. Mam. N. Am.).

[*Odontocœlus*] *americanus couesi*, Elliot, Field Col. Mus., Zool. Ser., IV, Pt. 1, 1904, p. 70, fig. xxiii (Mam Mid. Am.).

Type-locality.—Camp Crittenden, Pima County, Arizona.

Geographical range.—Southwestern New Mexico, southern Arizona (chiefly south of the Gila River), and southward in Chihuahua and Sonora, Mexico. Its vertical range extends from near sea level to the boreal summits of the highest mountain ranges of the region.

Description.—A male (No. $\frac{20776}{35950}$, U.S.N.M.), killed by Mr. Holzner in the Patagonia Mountains, November 27, 1892, and a female (No. $\frac{21424}{36285}$, U.S.N.M.) from the Pajaritos Mountains, near Nogales, December 24, 1892, are in complete winter pelage. The color above is brownish gray, much paler than in *Odocoileus americanus*. The hair is fine for a deer, and nearly straight: drab-gray at base, darker on the terminal portion, which is finely ringed with white and pointed with black, which gives the usual pepper-and-salt mixture of color common to most species of *Odocoileus* in winter pelage. There is a dark, brownish, vertebral area extending backward from the crown, most intense on the upper side of the neck; and low down on the sides the color becomes pale drab-gray, stained below with yellowish brown, which becomes most intense around the axillæ and posterior border of the thighs, which are edged with wood brown. The abdominal and inguinal regions, together with the hollows of the thighs and axillæ, are white. Chest brownish drab-gray.

The tail in this deer (fig. 10) is broad, full, and foxy, being hairy below almost or quite to the base, and entirely white on the under surface. The white of the underside shows as a border to the colored upper surface, which is dull cinnamon, the outermost colored hairs being pointed with black, giving definition to the pattern. Where the tails are worn, the dark brown color of the bases of the hairs is exposed; and near the tip this dark color is almost always seen. The feet present a grizzled mixture of fawn-color, drab, and white, which is wholly different from their coloring in summer. The hoofs are usually black, sometimes horn-color at their points; but one specimen has the front hoofs horn-color throughout. The metatarsal gland (fig. 11) is small. The head lacks the blackish horseshoe mark which the face of the mule deer exhibits, its color being similar to that of the back. There are white or grayish-white areas occupying the chin, throat, lips, end of muzzle, space around orbits, and at base and inside of ears. The eyelashes and edge of lids are black, and there are black spots behind and at each side of the naked muffle, and at each side of the lower jaw. The ears are gray on convex surface, white on the inside, the white extending a short distance around on the outer surface at base posteriorly; they are without black edges or tips. There is considerable variation in the coloring of different individuals in winter. Some have rusty yellowish markings about the forehead, horns, and below and in front of the eyes. An old male (No. 58862, U.S.N.M.), with mature horns, killed in the Santa Catalina Mountains, November 18, 1893, lacks reddish colors on the head, which has just received the winter coating, all of the hairs being acutely pointed, and most of them having white tips, which produces a peculiar effect of hoariness. From the color of the hair beneath it is evident, however, that a little wear would remove this and restore the usual coloring. This is seen to be the case in an old female (No. 59229, U.S.N.M) killed at Pozo de Luis, Sonora, January 2, 1894.

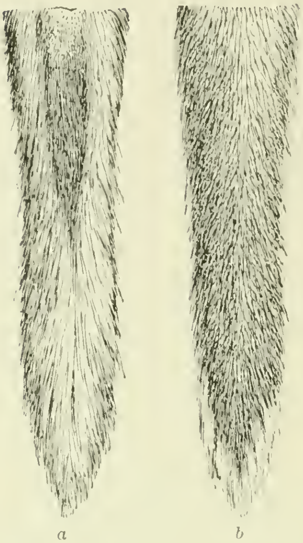

Fig. 10.—Tail of Odocoileus couesi. (Cat. No. 20571, U.S.N.M.) *a*, under surface; *b*, upper surface.

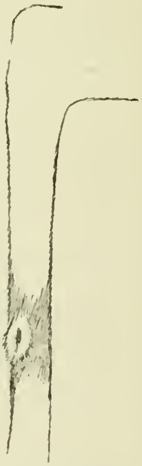

Fig. 11.—Odocoileus couesi. Metatarsal gland. (Cat. No. 59229, U.S.N.M.)

A pregnant female (No. 20349, U.S.N.M.), killed June 3, 1892, in the San Luis Mountains, is in full summer coat. Above brownish fawn-color, slightly dusky in the vertebral area, deepening to cinnamon on the chest, sides, and upper surface of tail. Feet, fawn-color anteriorly and externally, paler within and posteriorly. Abdomen, inguinal region, underside of tail, chin, throat, and inner surface of upper part of limbs, white. Top of head dusky brownish in the median area. A younger female (No. 20571, U.S.N.M.), from the San Luis Mountains, contained two small fetuses, and was still in winter pelage when killed, June 19, 1892. A young male (No. 20569, U.S.N.M.), killed at Cloverdale, Grant County, New Mexico, July 15, 1892, was still in winter coat. Still another young male (No. 21394, U.S.N.M.), taken on San Bernardino River, Sonora, August 19, 1893, was in summer pelage; but an immature female (No. 21413, U.S.N.M.), from the Guadalupe Mountains, south of Monument No. 73, was just acquiring the summer pelage on its feet, August 26, 1893. An old male (No. 58928, U.S.N.M.), killed on Cajon Bonito Creek, Sonora, August 29, 1893, is in the tawny summer coat, except on the sides, where the summer hair has fallen out in masses, exposing large patches of short, grayish winter hair. All of the rest of the animal is in summer pelage, fawn-color, becoming cinnamon on the posterior border of the thighs, and on the sides and tail. An old male (No. 20686, U.S.N.M.), killed on San Bernardino River, Sonora, September 5, 1892, shows the short winter coat over the entire body, through the scanty summer hair, which is still retained on all parts of the body, though most of it has been molted hair by hair, but nowhere in masses. An old male (No. 20682, U.S.N.M.), killed on the summit of the San Jose Mountains, Sonora, October 1, 1892, is in short winter coat, with many scattered hairs of the summer coat all over its body.

Young in first pelage.—The young are usually dropped during July. A male and female, twins, taken early in August, are almost exactly alike. Above russet fawn-color, with two central and several lateral rows of white spots. The central pair—one on each side of the vertebral column—are regular, beginning at the root of the ear as stripes which change to spots along the neck; on the back these pure white spots are surrounded by scattered black hairs. The lateral white spots are not surrounded by black hairs, and the rows are irregular, being most numerous on the outside of thighs. The reddish color of the back deepens to bright russet on the upper side of the tail, but fades on the sides, becoming pure fawn-color along the edge of the belly. The belly, inner sides of limbs down to "knee-" and "hock-joint," underside of tail, chin, throat, and inside of ears are white. The sides and front of neck, and the chest, are mixed gray, white, and rufous. The outer sides of limbs are russet fawn-color with some black anteriorly. There is some white spotting around the hoofs, which are plumbeous-black, tipped with horn-color. The top of the head, and convexity of ears are grayish, mixed with dusky brown. Eyelashes jet black.

Weight.—Maj. Charles E. Bendire, who became very familiar with this deer through the necessity of subsisting the men of his command largely upon the flesh of this and the mule deer when campaigning in Arizona during the early days, informed me that the weight of old bucks ranged from 60 to 100 pounds. This accords with my observation. Two females (Nos. 20349 and 20350, U.S.N.M.), (one of them immature but fat), weighed 50 pounds each when eviscerated. Another female (No. 20576, U.S.N.M.) weighed 60 pounds, gross. Fat old bucks were estimated at 80 pounds, gross weight; but none were weighed. Unaided, I easily lifted the largest upon my horse, attached it behind the saddle, and rode to camp. This would not have been possible with the mule or Crook deer.

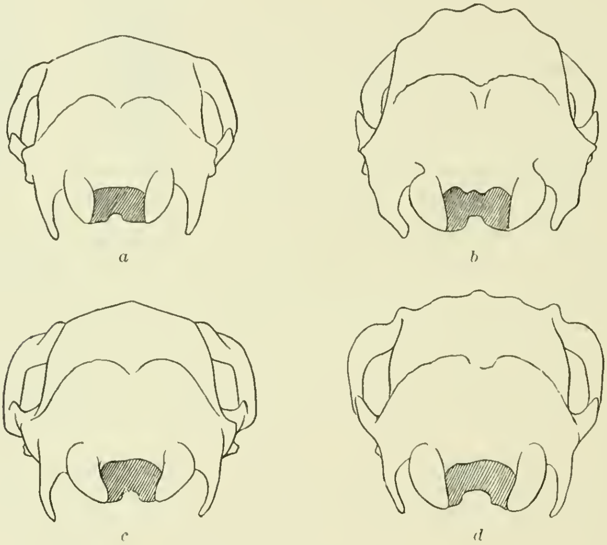

Fig. 12.—Skulls of Odocoileus. Viewed in profile from behind. *a*, O. couesi; *b*, O. americanus; *c*, O. crooki; *d*, O. hemionus canus.

Cranial characters.—The skull, viewed in profile from behind (fig. 12*a*) is high, but squarish, not dome-shaped as in *Odocoileus americanus* (fig. 12*b*); but the parocipital processes are thick and rather short, like those of *D. americanus*, quite different from those of *O. crooki* and the members of the *hemionus* group, in which they are long and slender (figs. 12*c*, *d*). The large, inflated auditory bullæ (fig. 13*b*), together with the small size of the skull, will also readily serve to distinguish it from *O. americanus*. The auditory opening is larger and more prominent, the lateral profile of the brain case is quite different, the skull as a whole is less slender, and the mandibular ramus more nearly vertical than in *O. americanus*. The zygomatic process of the squamosal (fig. 13*a*) is straighter than in other species, lacking the sharp elbow seen in the *hemionus* group.

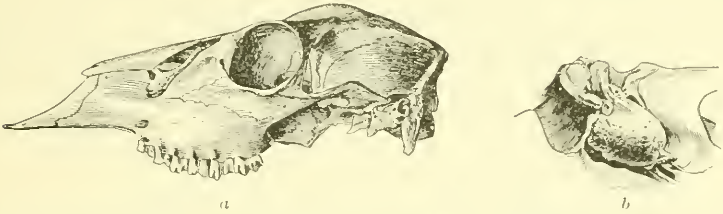

FIG. 13.—ODOCOILEUS COUESI. *a*, SKULL, LATERAL VIEW (Cat. No. 59229, U.S.N.M.); *b*, AUDITORY BULLA. (Cat. No. 37086, U.S.N.M.)

The base of the vomer is not fused throughout, but free posteriorly (fig. 19*b*). The horns (fig. 14) are rather stout, but short.

Cranial measurements of 8 specimens of Odocoileus couesi.[a]

U. S. National Museum number. Skull.	U. S. National Museum number. Skin.	Original number.	Locality.	Sex and age.	Total length of skull.	Greatest width of skull.	Distance between orbits, taken opposite center.	Distance between pedicels of horns.	Nasal bones, greatest length.	From front of premaxillary bone to hinder margin of palate.	Length of maxillary tooth row.	Distance between last upper molars.	Lower jaw, length, measured to end of coronoid process.	Length of mandibular tooth row.
					mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
58928	58928	2475	Cajon Bonito Creek....	♂ ad	248	115	87	73	71	155	71	45	216	80
35816	20682	2111	San Jose Mountain	♂ ad.	240	110	80	58	75	150	69	43	205	75
58862	58862	2662	Santa Catalina Mountains, Arizona.	♂ ad	255	107	78	71	78	151	66	45	214	70
35751	20574	1891	San Luis Mountains....	♀ ad.	221	97	67	....	63	140	63	38	190	71
37085	20350	1838	Do	♀ ad.	210	97	70	....	78	117	69	38	203	73
36320	21395	2513	Do	♀ ad.	230	91	63	....	67	140	62	38	193	67
35748	20576	1986	Cloverdale, New Mexico.	♀ ad.	241	103	72	....	68	153	62	39	205	71
59229	59229	2755	Pozo de Luis, Sonora ..	♀ ad.	242	103	71	....	71	150	67	38	205	71

[a] All are adults in which the permanent premolars are considerably worn.

The renewal of the horns.—The first young horns of a two-year-old buck (No. $\frac{20569}{35750}$, U.S.N.M., Cloverdale), killed July 15, were covered with fresh velvet, and measured 51 mm. in length. Another in the second year (No. $\frac{20776}{35950}$, U.S.N.M.) had hard, polished spike horns 95 mm. in length when killed, November 27. An adult male (No. 59928, U.S.N.M.), killed August 29, had vascular horns only 110 mm. high. An old male (No. 20686), taken September 5, 1892, had horns in mature velvet. Two adults, killed September 8, 1893, had large horns in velvet just beginning to rub off. Another old male (No. $\frac{20682}{35816}$, U.S.N.M.), killed October 1, had fully grown horns, but still covered with velvet. Still another adult male (No. 58862, U.S.N.M.), killed November 18, had perfect horns, from which the velvet had entirely disappeared.

Dental characters.—The teeth of the incisor-canine series, like those of *Odocoileus texanus* and other white-tailed deer are small and narrow compared to those of the black-tailed and mule deer. (Fig. 15.)

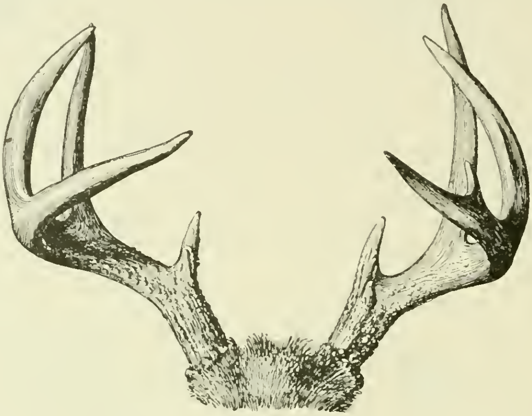

Fig. 14.—Odocoileus couesi. Antlers of adult. (Cat. No. 59230, U.S.N.M.)

Replacement of the milk teeth.—The mandibular incisors are the first to be replaced. The permanent canines and incisors—found only in the under jaw—are perfected by the time the last molar has risen to its place and before any milk molar has been shed. A male (No. 35750, U.S.N.M.), about a year old, killed July 15, with its mother,[a] had acquired the first (inner) permanent incisors, the second being plainly visible, carrying the corresponding milk tooth on its summit. Its growing horns, in velvet, were 51 mm. in length. The last lower molar is just rising above the alveolar socket, and the hindermost upper molar is just breaking through its bony capsule.

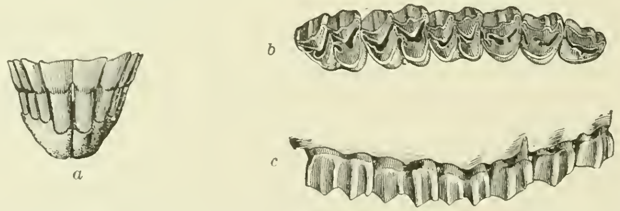

Fig. 15.—Odocoileus couesi, Teeth of adult females. *a*, Incisor-canine series viewed from in front; *b*, crowns of right upper molars; *c*, outer lateral view of right upper molars.

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[a] The mother (No. $\frac{20576}{35748}$, U.S.N.M) contained two fetuses, about to be born, one of which (No. 20558, U.S.N.M) was preserved.

An older male (No. 58929, U.S.N.M.), killed August 29, has the last molars slightly more advanced, and the second milk incisor has disappeared on the left side, the right resting on the apex of the second permanent incisor. Another male, perhaps sixteen months old (No. $\frac{20776}{35950}$, U.S.N.M.), had perfected spike horns measuring 95 mm. in length November 27, and had all of its permanent front teeth. Its last molars have not risen quite up to the level of the first and second molars. The first lower premolar is appearing beneath the posterior milk molar. It is clear, therefore, that the full complement of 32 teeth is completed shortly after the hardening of its first horns, leaving the milk molars to be replaced by the permanent premolars in the period immediately following. The order of replacement of the milk molars is from behind forward. The permanent dentition is probably acquired by the time the second horns have started, or when the animal is a little more than two years old. At any rate, a female killed with its mother (Nos. $\frac{20349}{37086}$ and $\frac{20350}{37085}$, U.S.N.M.) June 3, nearly as large as its mother and presumably almost two years old, had shed all but four (three upper and one lower) of its milk molars, so that it would have completed its dentition about the time its mother's next fawn should be born—about the end of July, as judged by the size of the fetuses.

Habitat and habits.—This small and exquisitely graceful deer occupies the southwest corner of New Mexico and southern Arizona, but does not range far to the northward. Three mounted specimens of this deer in the U. S. National Museum were taken by Mr. E. W. Nelson at Blue River, Graham County, Arizona, November 13 and 14, 1890. I never saw it in northern New Mexico or Arizona, and even in the higher portions of the Gila Basin it is rare or absent. During a residence of four years at Fort Verde, central Arizona, none were seen. On the night of October 6, 1884, General Crook's party reached a fork of Canyon Creek, in Tonto Basin, Arizona. The Indians who met us there had killed several deer when guiding the Fort Apache pack train to this camp with a cargo of grain for the animals of the command. One of the skins was small and reddish instead of grayish, and from an Indian named Peaches I learned that it was this species and not the mule deer. On the 15th of the same month we saw them alive for the first time in the canyon between Black River and Ash Creek, near the road from Fort Apache to the Gila River. On the Gila the whites called them fan-tails or dwarf deer. Mexicans simply called them "Cuervo" (*Cacalote*). Three were seen at Mr. Hutchinson's horse camp on the rim of Bloody Basin, between forts Verde and McDowell, April 19, 1888. In the oak and juniper woods of that locality Mr. Hutchinson had killed several "fan-tails" and many "black-tails" or mule deer. This is the most northern point at which I found *Odocoileus couesi*. Its range is mainly south of the Gila, where it is still abundant though its numbers are decreasing. On the lower Gila it was said to abound in the mountains north of Gila City. We were also told that it occurs sparingly all the way to the mouth of the Colorado River, along which it is restricted to the wooded river bottom, but we did not meet with it there. No deer were killed by my party in crossing the Colorado Desert. Tracks were numerous along the Salton and New rivers; some of those along the Salton, at least, may have been those of this species; but we obtained no proof of its existence beyond the Colorado River.

A belief is prevalent among the settlers of Arizona that a "dwarf deer," much smaller than the Sonoran white-tail, inhabits southern Arizona and northern Sonora, in proof of which I have been shown small, scraggy horns at Safford, Tombstone, and Nogales which were said to be those of this "dwarf deer" or (sometimes) "fan-tail." I also found similar shed horns, but saw no white-tailed deer that were different from the present species. A similar view is held respecting the female or young bighorn, which is locally called the "ibex" in central Arizona.

On the Mexican Boundary we did not meet with this deer until in going west we had passed Monument No. 63. From the east base of the San Luis Mountains to the Santa Rosa range on Sonoyta River the species was found in all suitable localities. None were actually seen beyond the Santa Rosa range. I saw it on the Bavispe River, Sonora, and on the highest peaks of the San Luis, Guadalupe, Niggerhead, San Jose, Huachuca, Pajarito, Poso Verde, and Cobota mountains. Although it delights in the shaded thickets bordering streams at all levels, it seems, especially during the breeding season, to have a predilection for mountain summits. Mr. Hall, whom we found domiciled in a cabin in Guadalupe Canyon, in 1892, had spent several years in that wild region endeavoring to establish a cattle ranch; but Indians had killed his cattle and his vaqueros, and he himself was killed by Mexicans the following year. From this plucky settler I learned much that was of interest about the animals of the region. Mr. Hall said that the Sonoran deer sometimes congregate in herds during winter, when they descend from the mountains. He had seen hundreds of bucks assembled—a forest of horns. We saw no herds, but small groups were very numerous in some localities. In 1893, a hunting party from Fort Huachuca reported killing 36 deer on a trip of a few days to Cajon Bonito Creek, Sonora. We found this species abundant on both sides of the San Luis Mountains, where many were killed to furnish food for our party. Next to the antelope it furnished us with the greatest amount of venison. It was last found in abundance in the region about Paso de Luis, Sonora, where several were killed by members of our party. At this place horns had been cast off in the greatest number.

During the breeding season many of the does ascend the higher mountains in company with their progeny of the preceding year. The young, sometimes one, but usually two, are born during July. A female killed at Monument No. 65, on the San Luis Mountains, June 2, 1892, contained one fetus the size of a jackrabbit, and was accompanied by her two young of the last season, one of which also contained a fetus; one shot June 19 on the east side of the same range contained two fetuses; one taken at Cloverdale, New Mexico, July 15, 1892, contained two young (both male) ready for birth, and a fourth, shot beside Cajon Bonito Creek, Sonora, July 24, 1892, contained two fully grown spotted fawns.

The Sonoran deer is the most beautiful species known to me. When surprised in thickets bordering the streams, it sometimes evinced more curiosity than fear. On September 11, 1893, I reached the summit of the highest peak of the San Luis range and was resting in a thicket close to the summit when a sound caused me to bring up my rifle ready for use. I half expected to see an Apache of the Kid's band, but instead a beautiful doe appeared, followed by a couple of spotted fawns, that immediately began to nurse. I was unseen, and the wind carried my scent from them; but the mother tarried but a moment and then disappeared over the ridge, where I heard the patting of her hoofs and the sound of sliding stones as she bounded away, closely followed by her nimble progeny. This deer usually goes to water about midday and often spends the hottest part of the day in the shade of willows and cottonwoods that fringe the streams.

January 10, 1885, Mr. E. W. Nelson wrote me from Springerville, Arizona, as follows:

> When you get ready to prepare your notes on Arizona mammals, I will be able to furnish you some interesting facts concerning some of the larger species, especially the elk, mountain sheep, white-tailed deer, and other species. The mountain sheep is virtually extinct here now, and the elk will be in a year or two more.

It would be interesting to know whether the "white-tailed deer" mentioned were *Odocoileus couesi* or *O. crooki*.

Mr. E. W. Nelson, as already mentioned, sent three specimens of *Odocoileus couesi* to the U. S. National Museum. He collected them at Blue River, Graham County, Arizona, November 13 and 14, 1890.

Measurements of 11 specimens of Odocoileus couesi.

U. S. National Museum number. Skin.	U. S. National Museum number. Skull.	Original number.	Locality.	Date.	Sex and age.	Total length.	Tail to end of vertebræ.	Ear from crown.
						mm.	*mm.*	*mm.*
21424	36285	166	Nogales, Sonora, Mexico	Dec. 24, 1892	♀ im.	1330	206	197
20350	37085	1838	Summit of San Luis Mountains, Monument No. 65.	June 3, 1892	♀ ad.	1430	230	175
20349	37086	1839	do	do	♀ im.	1340	215	190
20576	35748	1986	Cloverdale, Grant County, New Mexico.	July 15, 1892	♀ ad.	1410	215	180
20569	35750	1988	do	do	♂ juv.	1290	220	178
20577	(?)	2020	West slope of San Luis Mountains	July 21, 1892	♂ ad.	1510	240	190
20684 20686	....	2104	San Bernardino Ranch	Sept. 5, 1892	♂ ad.	1530	270	203
20682	35816	2111	San Jose Mountain, Sonora, Mexico	Oct. 1, 1892	♂ ad.	1410	220	180
58928	58928	2475	Cajon Bonito Creek, Sonora, Mexico	Aug. 29, 1893	♂ ad.	1430	260	205
21414	....	2514	Cajon Creek, Chihuahua, Mexico	Sept. 8, 1893	♂ ad.	1390	220	180
59229	59229	2755	Pozo de Luis, Sonora, (?) Mexico	Jan. 2, 1894	♀ ad.	1450	260	183

U. S. National Museum number. Skin.	U. S. National Museum number. Skull.	Original number.	Locality.	From tip of nose to— Eye.	From tip of nose to— Base of ear.	From tip of nose to— Occiput.	Forelimb from olecranon to end of hoof.	Length of manus.	Hindlimb from knee-joint to end of hoof.	Length of pes.	Height of animal at shoulder.	Height of animal at hips.
				mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
21424	36285	166	Nogales, Sonora, Mexico	137	237	251	480	275	612	380	683	746
20350	37085	1838	Summit of San Luis Mountains, Monument No. 65.	143	235	260	505	280	565	380	800	825
20349	37086	1839	do	138	235	245	490	280	620	370	730	810
20576	35748	1986	Cloverdale, Grant County, New Mexico.	150	230	270	505	282	650	387	820	880
20569	35750	1988	do	135	204	245	510	285	580	380	740	825
20577	(?)	2020	West slope of San Luis Mountains.	150	230	290	550	295	630	415	800	880
20684 20686	....	2104	San Bernardino Ranch	158	235	280	530	293	610	402	875	885
20682	35816	2111	San Jose Mountain, Sonora, Mexico.	150	230	285	520	290	600	395	860	870
58928	58928	2475	Cajon Bonito Creek, Sonora, Mexico.	150	240	280	537	295	650	400	810	840
21414	....	2514	Cajon Creek, Chihuahua, Mexico.	145	220	270	540	280	620	410	880	890
59229	59229	2755	Pozo de Luis, Sonora, (?) Mexico.	151	233	260	527	280	625	390	790	870

ODOCOILEUS CROOKI (Mearns).

CROOK BLACK-TAILED DEER.

Dorcelaphus crooki MEARNS, Proc. U. S. Nat. Mus., XX, p. 468, Dec. 24, 1897. (P. 2 of advance sheet issued Feb. 11, 1897; original description.)

Odocoileus crooki, MILLER and REHN, Proc. Boston Soc. Nat. Hist., XXX No. 1, Dec. 27, 1901, p. 15 (Syst. Results Study N. Am. Mam to close of 1900).

Cuerro (*Cacalote*) of the Mexicans.

Akw'aka of the Haulapai Indians.

Pe-ash -Book-tse-ga of the Hopi Indians.

Type-locality.—Summit of the Dog Mountains, Grant County, New Mexico. Altitude, 1868 meters (6,129 fet). (Type, No. $\frac{20572}{35752}$, U. S. National Museum.)

Geographical range.—Mountains of western New Mexico and eastern Arizona (Dog Mountains, New Mexico, to Bill Williams Mountain, Arizona). It belongs to the Transition zone of the Elevated Central Tract.

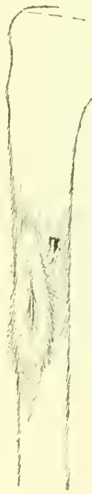

FIG. 16.—ODOCOILEUS CROOKI. METATARSAL GLAND OF TYPE. (Cat. No. 20572, U.S. N.M.)

Description.—Adult female (type, killed June 9) in summer pelage: Similar in form to the black-tailed deer of the Columbia River (*Odocoileus columbianus*), but much paler and probably smaller, with larger ears. Color reddish fawn, darker from black annulations on the back, lightening to grayish cinnamon on the sides, and grayish drab on the neck. The legs are cream-buff, except where new clay-colored hair is coming in on the anterior border, the limbs being almost the last part to receive the summer coating. The coloring of the head is very similar to that of the mule deer in corresponding pelage. It has the horseshoe or arrow-mark on the forehead, and other dark markings of the head to correspond; and the ears are relatively almost or quite as large, and as scantily coated with hair. The bushy hair around the metatarsal gland (fig. 16), which agrees in size and location with that of *Odocoileus columbianus* (Richardson), is sooty at the base, and white apically. The tail (fig. 17) is colored much as in *O. columbianus*, but has a longer terminal switch; upper side and extremity of tail all black, lower side white mesially, and naked toward the base. The pelage of this deer is short and coarse in comparison with that of the white-tailed deer of Virginia or the black-tailed deer of the Columbia River region, and, as would naturally be expected, is not so red as that of the latter. The type contained a fetus the size of a cotton-tail rabbit. The dimensions of this individual, measured by the author, from the fresh specimen, are as follows: Total length, measured in a straight line, 1,440 mm.; tail vertebræ, 195 (to end of hairs, 304); ear above crown, 220; ear above notch, 190; ear, width, following curve, 125; distance between eyes, 100; girth of chest, 790; distance from head of humerus to head of femur, 620; from tip of nose to eye, 155; to center of pupil, 175; to base of ear, 290; to tip of ear, 470; to occiput, 295; height of animal at shoulder, 650; fore limb from coracoid to end of hoof, 630; from olecranon, 540; length of manus, 300; hind limb from knee-joint, 620; length of pes, 400. Weight, eviscerated and dry, 72 pounds.

A male of the second year, bearing horns with a single fork near the end (No. $\frac{2172}{11144}$, Am. Mus. Nat. Hist.; No. 159, Mearns's collection), killed near the base of Bill Williams Mountain, Arizona, December 5, 1884, is in complete winter pelage. It is in the shaggy pelage of bluish gray or pepper-and-salt, which hunters call the "blue" coat, the color being quite similar to that of the mule deer at the same season. Upper parts ash plumbeous, grizzled with gray and black, with a very slight rusty tint posteriorly and along the sides. The individual hairs are very pale drab at base, shading to plumbeous, then annulated with grayish white and pointed with black. As in the mule deer, the color is darkest along the middle of the back, where the black points are widest, growing paler laterally as the black points are gradually reduced in width and finally become obsolete. The pelage is much finer and more furry than that of the mule deer, and the grizzling correspondingly finer. Upon the head the grayish-white annuli are sharper and broader than elsewhere, notwithstanding which the face has a blackish aspect, which is heightened by a black V-shaped mark between the eyes, formed by two stripes beginning, one on either side, about 13 mm. internal to the inner canthus of the eye, and converging forward to meet in the median line at the base of the nasal bones. The naked[a] muffle is separated from three black triangular areas—one above and two lateral—by a narrow band of white which also encircles the nostrils. Upon the upper border of

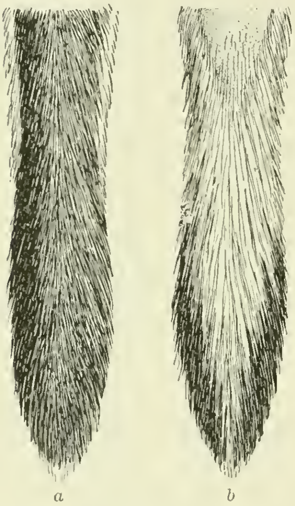

FIG. 17.—ODOCOILEUS CROOKI. TAIL OF TYPE. (Cat. No. 20572, U.S.N.M.) *a*, UPPER SURFACE; *b*, LOWER SURFACE.

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[a] Although usually described as naked, the muffles of the deer are studded with tufts of capillary hairs, with a long bristle emerging from the center of each of the tufts, which are rather symmetrically disposed in rows.

the muffle this band assumes the eccentric form of a small round spot, sending off lateral prolongations to join the white circles around the nares. The bases of these black triangular spots correspond to the upper margin of the muffle above and to the outer border of the nostrils laterally, those at the sides blending apically with the whitish area behind them and becoming obliterated toward the angle of the mouth; below them are two white patches, also triangular, forming a border to the upper lip, their bases corresponding to that portion of the sides of the muffle which is below the nares. The chin, a broad stripe around the angle of the mouth, and the muzzle behind the region just described, are white. A light median area extends backward from the white muzzle, diverges so as to form an anterior border to the V-shaped space, becoming white and broadly encircling the orbits, thence passing indistinctly backward to the base of the ears behind, where there is a large patch of white. There is a smaller triangular white spot in front of the ear notch, and the concavity of the ear is clothed with long white hairs. Throat white, changing to ash plumbeous upon its sides by the abbreviation of the white tips which give the color to this region. Sides of neck ash plumbeous annulated with white. Convexity of ears grayish, like the rest of the upper surface, the coat being dense and rather long; terminal portion edged with blackish. There is a light rusty tinge in front of the base of the horns. The edge of the eyelids, lashes, and brows are jet black. The long bristles around the muzzle correspond in color to that of the hair, those above being black and those below white. Behind the white chin is a black spot at either side of the jaw, barely cut off from the edge of the lip by a narrow white line, and obscurely connected by a dusky grayish band extending across the jaw. Below the throat the neck is ash plumbeous, like its sides. At the chest the color changes abruptly to plumbeous or fuliginous black, growing lighter posteriorly. Except upon the axillæ, there is no white in front of the inguinal region, whence the white extends laterally to the inside of the thighs and upward to the tail, covering its under surface and the buttocks on either side, forming as conspicuous a patch, when viewed from behind, as in the mule deer. There is no white upon the limbs below the axillæ and hollows of the thighs. The tufts of bushy hair surrounding the tarsal and metatarsal glands are paler than elsewhere, but not conspicuously so; naked portion of the metatarsal gland, which is hard to find among the bushy hair, measures 13 mm. in length. The limbs are rather uniform light fulvous, to which a sandy hue is imparted by a slight admixture of rusty with the exposed plumbeous base of the hairs; their inner sides are somewhat paler and the anterior border rustier. A dusky spot is situated between the false and lower hoofs of the hind limbs. The dorsum of the tail is broadly black at the end, grizzled with gray, and rusty toward the base. The ears are extremely large and thick, densely coated with hairs on both surfaces, those of the concavity being long and somewhat curly. In proportion to the size of the animal the ears are nearly or quite as large as those of the mule deer. The tail is short, full, and foxy, the white hairs not covering more than the lower half of its surface. The metatarsal glands are smaller than those of the mule deer, larger than in white-tailed deer. They are surrounded by a small tuft of whitish hairs which barely suffice to mark their location. There are no dusky hairs surrounding the light ones. The tarsal glands are also small, with inconspicuous tufts. There is nothing distinctive about the form or size of the hoofs or antlers; their measurements are given below. Measurements of the fresh specimen (skinned, but with head and limbs entire): From tip of nose to eye, 150 mm.; to ear, 240; to tip of ear, 450; to base of horn, 225; to occiput, 280. Ear, height above crown, 190; above notch, 145; width, 110. Distance between eyes, 100. Girth of head behind antlers, 420. Tail to end of vertebræ, 210; to end of hairs, 275. Eye, from inner canthus to lachrymal opening, 13; length of lachrymal opening, 13. Front hoof, length of anterior edge (chord), 40; superior edge, 36; inferior edge (i. e., greatest length of hoof measured below), 66; from tip of hoof to base of accessory hoof, 100; width of one great hoof, 21; width of both taken together, 41; length of false hoof, its external edge, 28.5; its width at base, 17. Hind hoof, length of anterior edge, 40; superior edge, 34; inferior edge, 63; from tip of hoof to base of lesser hoof, 109; width of each great hoof, 18; width of both taken together, 35; length of accessory hoof, its external edge, 23; its width at base, 20. Antler, distance from burr to tip in a straight line, 164;

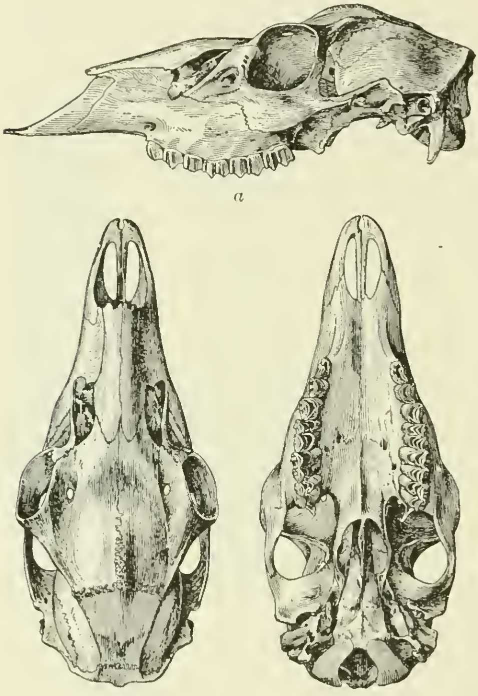

FIG. 18.—ODOCOILEUS CROOKI. SKULL OF TYPE. (Cat. No. 35752, U.S.N.M.) *a*, LATERAL VIEW; *b*, DORSAL VIEW; *c*, VENTRAL VIEW.

following the curve, 180; from the burr to the fork in a straight line, 124; longest tip, 52; shortest tip, 50; circumference of burr, 73; circumference midway between burr and tines, 49; circumference of tines, 25 and 35. Weight estimated at 70 pounds avoirdupois.

Cranial characters.—The skull of *O. crooki* (fig. 18) has very nearly the same conformation as that of *Odocoileus columbianus*, the lachrymal fossa being deeper than in the Virginia deer, but shallower than in the mule deer. The same intermediate condition obtains with respect to the vomer (fig. 19*c*), in the relationships of the nasal and premaxillary bones; and, in short, the whole animal appears to be a compromise between the characteristics of the white-tailed and mule deer groups. For the characters of the teeth see fig. 20.

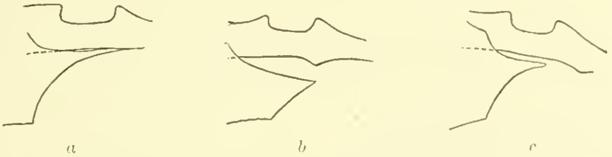

FIG. 19.—DIAGRAM SHOWING POSITION OF VOMER WITH RELATION TO BASI-SPHENOID. *a*, ODOCOILEUS HEMIONUS CANUS (Cat. No. 63141, U.S.N.M.); *b*, ODOCOILEUS COUESI (Cat. No. 59229, U.S.N.M.); *c*, ODOCOILEUS CROOKI (Type, Cat. No. 35752, U.S.N.M.).

Cranial measurements of two specimens of Odocoileus crooki.

Measurement.	No. 35752 U.S. Nat. Mus. female ad. (Orig. No. 1873.) Type.	No. 11144 male immature. Amer. Mus. Nat. Hist., N. Y. (Orig. No. 159.)
Total length of skull	255	260
Greatest breadth of skull	108	110
Distance between orbits, measured opposite center	73	72
Distance between pedicels of horns		52
Nasal bones, greatest length	82	82
Nasal bones, greatest breadth of pair	26	27
Nasal bones, least breadth of the pair	18	13
From tip of nasal to tip of premaxillary bone	53	57
Total length of premaxillary, measured in situ	69	67
Premaxillary bones, from front to premolars	80	82
Premaxillary bones, from front to hinder margin of palate	163	....
Length of upper toothrow	77	73
Distance between first upper premolars	34	34
Distance between last upper molars	40	45
Width of bony palate in front of teeth, at narrowest part	16	19
From hinder margin of molars to tip of paroccipital process	77	....
From posterior molar to anterior margin at foramen magnum		87
Length of lower jaw, measured to end of coronoid process	225	223
From cutting edge of inner incisor to first premolar tooth	78	79
Lower jaw, from angle to end of coronoid process	102	100
Length of lower lateral toothrow	87	81
Lachrymal fossa, length	33	30

Remarks.—This deer was apparently first discovered by Gen. George Crook, although I have seen no published reference to it. On December 5, 1884, Mr. Charles H. Allabach, a member of a hunting party conducted by General Crook, shot a 2-year-old buck—the one above described—near the base of Bill Williams Mountain, Arizona. The General, who was familiar with practically all of the species of deer of the United States and northern Mexico, at once noticed its dissimilarity from the mule deer, the whitetail, and the blacktail of Columbia River. He caused the head, legs, and skin of body to be collected and delivered to me at Fort Verde, Arizona, together with a message calling my attention to the large, clumsy ears, white buttocks, flattened tail, and other characters of the specimen. The following letters were subsequently received:

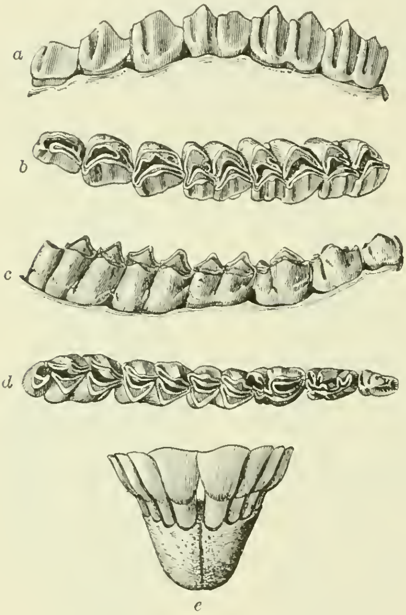

Fig. 20.—Odocoileus crooki. Teeth of type (Cat. No. 35752, U.S.N.M.) *a*, Profile of right upper molar series; *b*, crowns of same; *c*, profile of right lower molar series; *d*, crowns of same; *e*, incisor-canine series, front view.

Whipple Barracks,
December 23, 1884.

Doctor Mearns:

Dear Sir: This is the pelt of which General Crook telegraphed to you, but in a rather dilapidated condition. You will have to do some crazy-patch work if you desire to mount it. The antler was broken off and lost by the packers, but was facsimile of the other. It was killed near the base of Bill Williams Mountain on the 5th of December, 1884.

Yours, truly,
Chas. H. Allabach.

Prescott, *January 15, 1885.*

My Dear Doctor: The specimen sent you by Allabach is different from any I have seen in this country. It is larger, the upper side of the tail is of a different color, and it is inclined to be white on the buttocks around the tail. The black-tailed deer of California differs more widely from the mule deer than does the white-tailed deer. The only good description I have ever seen of it is in Judge Caton's book. I would like a pair of the crossbills.

Yours, sincerely,
George Crook.

I immediately wrote a description of the new species, but the manuscript was withheld from publication awaiting a more satisfactory type-specimen, which was not obtained until June 9, 1892, when I had the satisfaction of seeing several of these deer alive and of killing the type on Emory Peak of the Dog Mountains, where I noted its range as from 1,500 to 1,868 meters (4,921 to 6,129 feet) in the zone of alligator juniper. The cattlemen to whom I showed the specimen assured me that the species was recognized by them as different from the whitetail or the mule deer.

In 1889 Dr. D. G. Elliot saw more black-tailed deer in the Mogollon or San Francisco Mountains of western New Mexico, which from his description I supposed to be the Crook deer.

The Hualapai Indians were evidently acquainted with this deer, although they have no special name for it. When shown a specimen and asked to name it, an Indian named Qua-su-la replied, "Akwa'ka. Mim sabe!" But the Hualapai call the *mule deer* "Akwa'ka."

When shown the skin of the first specimen of Crook's deer, the Hopi said it was "Pe ash' Book tse ga."

We saw none west of the San Luis range, and learned nothing of its habits beyond the fact that it is agile and shy.

ODOCOILEUS HEMIONUS CANUS Merriam.

MEXICAN MULE DEER.

Odocoileus hemionus canus MERRIAM, Proc. Wash. Acad. Sci., III, p. 560, Nov. 29, 1901 (original description).

Odocoileus hemionus canus, MILLER and REHN, Proc. Bost. Nat. Hist., XXXI, No. 3, Aug. 27, 1903, p. 68 (Syst. Results Study N. Am. Mam. during 1901 and 1902).

[*Odontocælus hemionus*] *canus*, ELLIOT, Field Col. Mus., Zoöl. Ser., IV, Pt. 1, 1904, p. 78 (Mam. Mid. Am.).

Cuerro (*Cacalote*) of the Mexicans.

Akwa'ka of the Hualapai Indians of northern Arizona.

Sho-we'n'-hua; *Cho-we'-e boolk-tsi-ga'*; *Schu-we'-nig-wuh* of the Hopi.

Type-locality.—Sierra en Media, Chihuahua, Mexico (Type, No. 99361, U.S.N.M.).

Georgraphical range.—Inhabits southwest Texas, New Mexico, Arizona, and northern Mexico, ranging from the Sonoran to the Boreal zone in altitude. On the Boundary it was found from the Sierra Blanca Mountains, Texas, to the Huachuca Mountains, Arizona.

Description.—Smaller, paler, and grayer than in typical *Odocoileus hemionus* from Dakota. It also differs considerably from the mule deer of northern Arizona, which I tentatively include with it, especially in having a trace of a black line on the upper side of the tail, and in having smaller antlers and larger hoofs. An immature male (No. $\frac{20579}{35749}$, U.S.N.M.), killed at White Water, Chihuahua, Mexico, June 21, 1892, is first described because coming from near the type locality (Sierra en Media, in the State of Chihuahua). This individual, which was in faded winter coat, had horns—probably of the third year—in the velvet, 110 mm. in length, showing the basal snag. The animal was small, in rather poor flesh, and rather young but with mature dentition. Its weight, as killed, before evisceration, was 103 pounds (46.72 kilos.). Head and neck yellowish drab-gray, with a horseshoe mark of brownish black, grizzled posteriorly, occupying the crown; blackish along the anterior margin of the ear, around the eye, and on the end of the muzzle, laterally and superiorly, the latter connected with the horse-shoe mark of the crown by a faint, median, dusky line. Muzzle of a coarser pepper-and-salt mixture of grizzled drab. Region from base of ear to orbit dirty yellowish gray. Inner surface of ear very scantily coated with long, crinkled, grayish-white hairs. The legs are ochraceous buff externally, cream-buff internally, with the bushy hair surrounding the metatarsal gland (fig. 21) cream buff. The tail is long and slender, short-haired, bare underneath at base, white with a black terminal brush of bushy hair; there is a faint indication of a colored line along its upper surface (fig. 22).

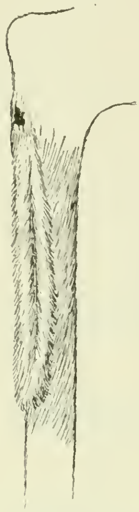

Fig. 21.—Odocoileus hemionus canus. Metatarsal gland. (Cat. No. 20570, U.S. N.M.)

An adult male in newly-acquired winter pelage (No. $\frac{2157}{19569}$, Am. Mus. Nat. Hist., N. Y.), killed at Fossil Creek, in central Arizona, November 27, 1885, weighed 128 pounds after being eviscerated and hung up in camp for several days. Upper parts nearly uniform grizzled plumbeous-gray, the individual hairs being pale at base, then ash-gray, subterminally annulated with white, the pointed tips being black; underparts, from neck to hinder abdomen, fuliginous-black, darkest in the median line, this color extending well up on the flanks and gradually becoming grayish; throat whitish; inner side of limbs whitish, this gradually shading into the brownish-yellow color of the outside of the limbs; outer surface of the fore legs, down to the ankle, and of the hind legs, down to the tibio-tarsal joint, colored like the back, but with a slight mixture of reddish or yellowish brown.

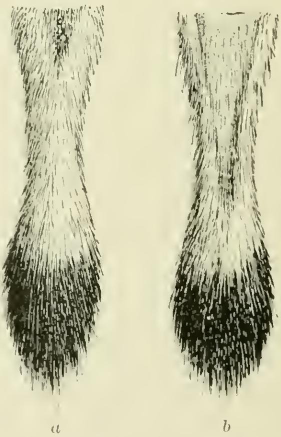

Fig. 22.—Odocoileus hemionus canus. a, Upper surface of tail; b, lower surface.

A young buck (No. 285, Mearns's collection), killed at the same time and place, having singly-forked horns, is indistinguishable in coloration from the adult above described, save that the blackish area inclosed by the ears, eyes, and horns is less grizzled and mixed with grayish white. The white of the throat and inner aspect of limbs above is nearly pure and unmixed. The head and neck lack the fullness of the old stag, being shaped like the does.

Two old does (Nos. 283 and 284, Mearns collection), killed at the same time and place as the two males last described, differ in color in being much paler, with more yellowish suffusion throughout, especially in the region of the axillæ and upon the outer side of the hips.

An adult male (No. 293, Mearns collection), killed between Clear and Sycamore creeks, tributaries of the Verde River in central Arizona, December 22, 1885, weighed about 175 pounds. This specimen had developed a coarse, almost shaggy coat, having completed the winter dress which hunters designate the "blue" coat. The hairs of the upper parts are bluish gray, but black and white annuli and points give a general pepper-and-salt effect to the coloration. The individual hairs are very pale bluish gray at base, subterminally annulated with whitish, the rings succeeded by tapering black points. The color is darkest in the median line above, especially from between the horns to the interscapular region and on a tuft of long hair at the end of the rump, covering the base of the tail, in these places many of the hairs being black throughout or with a very broad pointing of black and narrow annuli of whitish. Upon the sides and hips the annuli are broader and rusty tinted, giving a paler and slightly ferruginous cast to those parts. The hair surrounding the white buttocks is more decidedly rusty. The chest is sooty-plumbeous, darkest in front, fading to white on the inner surface of the thighs and hinder part of the abdomen, the white of the latter parts changing to pale yellowish brown on the inner side of the limbs at the heel. The mixed gray, black, and white color of the dorsum extends downward upon the outer side of the hind limbs nearly to the heel, the ferruginous washing to the white annuli appearing more strongly below, though changing quite abruptly to rusty brown just above the heel joint. The axillæ are white, changing upon the lower part of the fore limbs to creamy white. The color of the outer side of the forearm, from the elbow to the wrist, gradually becomes rusty brown. Below the radio-carpal joint the fore limb is creamy white on the inner and posterior surfaces down to the upper digits. The interdigital region is densely coated with long hairs, which are darker than the surrounding hair, this perhaps being due to earth staining. The anterior and outer aspect down to the hoofs is distinctly rusty or cinnamon color, the hairs being sooty at base instead of unicolor throughout, as are the whitish hairs of the opposite surface. The hind limbs, from the tibio-tarsal joint to the hoofs, are rusty yellowish brown upon the outer surface, and much paler upon the inner aspect.

There is a long tuft of dense hair of slightly darker color upon the inner side of the tarsus between the heel and upper articulating surface of the bone, and a similar growth upon the outer side in the region corresponding to the extent of the tarsal gland, which begins 9 mm. below the upper articulation, and measures 144 mm. in length, the surrounding hairs measuring 27 mm. in length. The head is grayish, with the usual black horseshoe mark, grizzled within, occupying the forehead, and blackish along the anterior margin of the ear, around the eye, and on the end of the muzzle. The tail is naked at base below, white all around on basal portion, with a heavily expanded black brush at the extremity; underside bare nearly to the black tip.

The summer coat of this deer is short and scanty, and of a reddish-brown color. An adult female (No. 612, Mearns's collection), killed at Bakers Butte, Mogollon Mountains, central Arizona, altitude 8,000 feet, July 26, 1887, weighed 105 pounds, after evisceration and removal of the feet. As killed, it probably weighed about 150 pounds. The upper parts are ash gray, densely overlaid by yellowish brown; chin, throat, and inner side of limbs white; chest without any of the sooty black color of the winter dress; eyelids black. An adult male, killed by Gen. George Crook at Mud Tanks, 20 miles east of Fort Verde, Arizona, October 2, 1884, had the horns hardened, but still entirely covered by "velvet," and had acquired the bluish winter pelage.

The young are usually born during the late spring and summer months, and at first have a spotted coat, in which I have seen them as late as the end of October, in the mountains of central Arizona. One of a pair of twin bucks, in spotted coat, taken in the Black Hills, near Jerome, Arizona, about October 1, 1887, is described in my notes of October 9 as follows: The eyes are large and exceedingly beautiful, the eyelids having long black lashes. The location of the tarsal and metatarsal glands is marked by well-defined tufts of yellowish brown hair. The dorsum is yellowish brown, with chains of small white spots. Pelage of upper parts ash gray, much mixed with yellow brown, the head, ears, shoulders, and flanks being the purest ash gray. The back is decidedly brown, darkest in the median line, in an area defined by longitudinal rows of white spots extending from the occiput to the rump on either side of the spine. There are a few white spots lower down, upon the fore part of the shoulders, several irregular rows upon the sides, and others extending much lower upon the thighs. The outer side of the limbs is decidedly yellowish and the inner side soiled white. The base of the ears externally, sides of head, lower jaw, and throat are ashy white. Nasal pad and hoofs glossy black. Edge of ear narrowly rimmed with white. A large ovate spot, occupying nearly the whole forehead, is dusky from a liberal admixture of black hairs; along its outer border this spot becomes nearly black. There is a black area adjoining the nasal pad, which is prolonged backward along the upper lip, becoming obsolete at the angle of the mouth and indistinct across the lower jaw. Tufts of yellowish brown hair mark the places where the horns are to appear. The outer surface of the ears is blackish along the border terminally; there is a dusky spot on lower border of inside of the ear and a blackish spot between the ears. The chest and breast are dark fuliginous. Abdomen, inguinal region, buttocks, and basal portion of tail pure white. The animal was molting and the white spots rapidly disappearing. Hunters informed me that the spotted coat in fawns of the mule deer lasts but a few weeks.

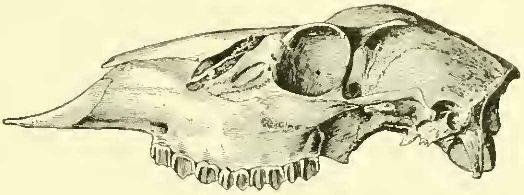

FIG. 23.—ODOCOILEUS HEMIONUS CANUS. EL PASO, TEXAS. (Cat. No. 63144, U.S.N.M.)

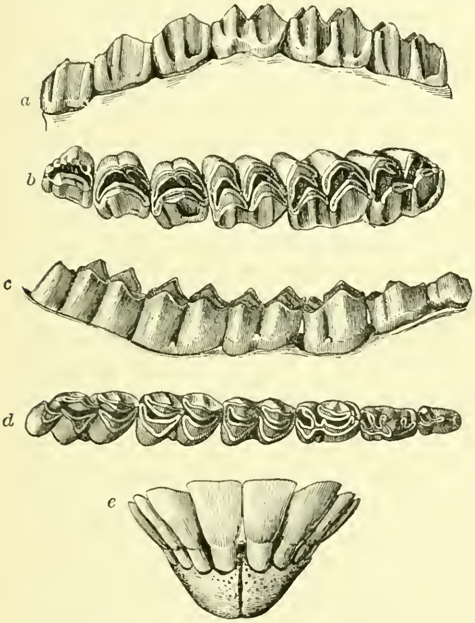

FIG. 24.—TEETH OF ODOCOILEUS HEMIONUS CANUS. (Cat. No. 63144, U.S.N.M.) *a*, PROFILE OF RIGHT UPPER MOLAR SERIES; *b*, CROWNS OF RIGHT UPPER MOLAR SERIES; *c*, PROFILE OF RIGHT LOWER MOLAR SERIES; *d*, CROWNS OF RIGHT LOWER MOLAR SERIES; *e*, INCISOR-CANINE SERIES, FRONT VIEW.

Skull and teeth.—Compared with the white-tailed deer of the *Odocoileus americanus* group, which includes *O. texanus* and *O. couesi* of the present work, skulls of the members of the mule-deer group have the brain-case low and flattened (fig. 23). The posterior facets of the occipital condyles are concave internally instead of straight or convex. The lachrymal fossa is large and very deep. The vomer is fused to the basisphenoid instead of hanging free (fig. 19*a*). The premaxillary very rarely articulates with the nasal bone, being intercepted by a broad process of the maxilla. The mandibular ramus is more nearly vertical. The lateral teeth (fig.

24*a–d*) are very large, the premolars are relatively wider, and the second and third premolars more deeply grooved internally than in members of the *americanus* group; and the incisors, notably the second, are broader and the series more spreading (fig. 24*e*).

The horns.—The members of the mule deer group are distinguished by dichotomous horns. Variations in a selected series, from central Arizona are shown in the table of measurements on pages 204 and 205, to which the diagram below (fig. 25) relates. The subspecies *canus* differs from typical *hemionus* in having the antlers lighter and more slender; as in that form, the beam is short, and concave anteriorly. In young bucks the horns begin during the first year as simple spikes, which, when shed, are replaced by singly forked ones, whose successors become more complex and compoundly dichotomous. The horns can be detected beneath the skin before the spotted coat of the male fawn has entirely disappeared. In central Arizona I saw a half-grown buck, still suckling, which had horns just starting through the skin, on December 29, 1885.

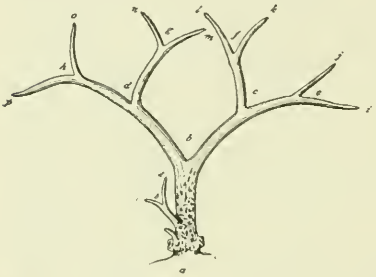

Fig. 25.—Diagram of antlers of Odocoileus hemionus canus. (For use of lettering see tables on pp. 206–7.)

In the high region of central Arizona the mule deer carry their horns throughout the month of February. On April 11, 1887, I killed an old buck that had recently shed its antlers, at Pecks Lake, Upper Verde Valley, central Arizona. Bucks killed in the Mogollon and San Francisco mountains, June 1 to 20, 1887, had grown horns varying in length in different individuals from 2 to about 10 inches. During August and September I saw small herds in the mountains of central Arizona, composed entirely of old bucks, carrying large heads of vascular antlers in full velvet. Two bucks, killed November 9, 1885, on Ash Creek, Yavapai County, Arizona, furnish my earliest record of horns entirely free from velvet. A fine old buck, shot by Gen. George Crook at Mud Tanks, central Arizona, October 2, 1884, had antlers which had become hardened and nonvascular, but still retained their coating of velvet throughout. In November the velvet finally disappears from the horns, except in the abnormal males known to the frontiersmen as "cactus bucks."

Among the abnormal horns of the mule deer I have seen the following: On August 20, 1887, Mr. MacFarland[a] brought a female mule deer having horns in the velvet to my camp at Bakers Butte, in the Mogollon Mountains. This head was sent to the American Museum of Natural History in New York.

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[a] Mr. Andrew MacFarland, whose authority I shall frequently cite, guided the expedition commanded by Lieut. A. W. Whipple from the Mississippi River to the Pacific Ocean, by a route near the thirty-fifth parallel, when surveying a railroad route to the Pacific in 1853 and 1854.

More common than horned females are the "cactus bucks," emasculated males in which the horns, if shed, are not again renewed, or, if with horns, retain them permanently in the velvet with remarkable distortions. Of these I have examined five individuals in central Arizona and two in southwestern New Mexico. All were without testicles. In No. 165, Mearns's collection, killed January 20, 1885, on Beaver Creek, Verde Valley, central Arizona, osseous pedicles for the support of horns were developed but entirely overgrown by skin and short hair; and, as usual, the testicles were absent. The remaining six had snaggy, scragged horns, more or less coated with withered velvet. In shape the horns varied from an intricate mass of radiating prongs to single crooked spikes with a cluster of lesser ones at the base, no two being alike even on the same head. Specimen No. 612, skin and skull, Mearns's collection, in the American Museum of Natural History, New York, shot by me at Bakers Butte, central Arizona, August 3, 1887, is a good example of a "cactus" buck. It had four good sized teats and no testicles. Cactus bucks are usually fat and are considered superior to others, the meat being good at all seasons.

Weight.—The weight of old males of the Arizona mule deer was estimated at 175 to 220 pounds by Maj. Charles E. Bendire, who had much experience in the early seventies, when stationed in the field with troops at old Fort Lowell, near Tucson. The estimate is based on specimens actually weighed and agrees with the slender data that I am able to present in the accompanying table (p. 208). The weight of an adult male (No. 612, Mearns's collection), killed July 26, 1887, at Bakers Butte, Mogollon Mountains, central Arizona, was estimated at 150 pounds, as it weighed 105 pounds after bleeding, evisceration, and removal of its four feet.

Habits and local distribution.—In central Arizona the mule deer ranges upward in summer to the highest boreal summits of the Territory and down in winter to the lowest valleys, when the mountains are frozen and covered with snow. The young are born on the summer range in the mountains and on the higher mesas, but I am not able to determine the exact time of year, except that I saw a doe and fawn near Fort Verde in the middle of July, 1884. Of seven females brought in to our camp at Monument No. 15, about 50 miles west of the Rio Grande, March 20 to April 7, 1892, two were pregnant, containing a single fetus each. Mr. Charles Ryall brought twin fawns, in the spotted coat, to Fort Verde from the Black Hills, near Jerome, in Yavapai County, Arizona, October 1, 1887. I saw two young fawns in a herd of ten mule deer November 25, 1884, on Ash Creek, central Arizona. A large fawn, whose horns were appearing through the skin, was killed December 29, 1885, at Fort Verde, Arizona. Its mother was also shot and her udder was filled with milk. On the Mexican Border I saw a herd of does and fawns of the season at Monument No. 64, at the lower timber line of San Luis Mountains, June 29, 1892. But, as mentioned, these data fail to fix exactly the period during which the young are usually born.

Owing to the gentleness or stupidity of the mule deer and the openness of the country that it occupies, this fine deer is perhaps doomed to an early extinction, in view of which deplorable probability I will give its Arizona range, as known to me in the eighties, with more detail than would be otherwise required. Major Bendire's command killed 196 deer, the majority of them *O. couesi*, on hunting trips from Camp Lowell, Arizona, in the autumn of 1872. When I reached Fort Verde in March, 1884, the white-tailed deer had entirely disappeared from that region, although a few remained in oak and juniper woods on the rim of Bloody Basin, between forts Verde and McDowell; but mule deer were numerous from 1884 to 1888 in the valleys and low mesas from November to April, and very abundant in the forested mountains during the remainder of the year. The range included the entire area drained by the Verde Valley; and I saw them on every important tributary as far south as Bloody Basin. Hunting parties of soldiers sent out from Fort Verde frequently returned with wagon or pack train loaded with mule deer, antelope, and turkeys; but a diminution in the amount of game was apparent before I left the Territory in 1888. North and west of the Verde Valley I find mention of this deer in my notes at the following-named points in Arizona: Hutchinson's horse ranch, on the divide between the Verde and Agua Fria valleys; Ash Creek, Agua Fria Valley; Squaw Peak; Black Hills; near Prescott, on Lynch Creek, and at Point of Rocks, on Granite Creek; Hells Canyon; Ash Fork; Stones Lake, Black Tanks, Cataract Creek; Colorado Canyon, between Cataract Creek and Pine Springs; at Pine Springs; Colorado River at Vitz's Crossing; through the San Francisco forest; at Flagstaff; and on San Francisco Mountain, where we found it ranging to the highest aspen timber in early June, 1887, and were informed that its range extends to the upper timber line, and that it sometimes crossed the highest notches of the mountain. It was still abundant around Flagstaff. East and south of the Verde it was noted as follows: On the Mogollon Mesa, at Rattlesnake Tanks; Stonemans Lake; Pine Springs; Wood's Ranch; Quaking Asp Settlement; on the heads of Oak, Clear, Fossil, Sycamore, Pine, East Fork, and Turbine creeks; at

Saw Log; Mud Tanks; Bakers Butte; Fern Spring; Generals Springs; Lake Tanks; and Mormon Lake; in Tonto Basin, at Natural Bridge, Pine Creek; Strawberry Valley; Pine Creek Settlement; Payson; Tonto Creek; Canyon Creek; Cibieu Creek; Corduroy Creek; Forestdale; Camp Apache; White and Black rivers; between San Carlos and Coyote Springs; Globe City; Wheatfield; Mazatzal Mountains, and Wild Rye. In 1885, when accompanying a cavalry command from Fort Verde, Arizona, to Texas, mule deer were noted as follows: One was shot by a member of the Third Cavalry Band near Antelope Station, Yavapai County, Arizona, March 26, 1885; a large herd seen and one shot in the foothills near Hall's ranch, on New River, March 28; several noted as seen between Mountain Spring and Tres Alamos, on San Pedro River, April 8; noted from Steins Pass to Lordsburg, New Mexico, April 15; between Lordsburg and Separ April 16; from Separ to Gage April 17; returning, a herd was seen in cedar-clad foothills near Dragoon Summit, Arizona, May 2; at Bumble Bee and Antelope stations May 18; and between Antelope and Hances Cienega May 19, 1885.

As soon as snow falls in the mountains, the deer begin a gradual descent to their winter ranges in the foothills and valleys. We saw them between San Carlos and Coyote Springs October 19, 1884; at the lower border of the pine zone October 2, 1884; and in the red juniper zone by the end of October.

Not all of the deer leave the Verde Valley (3,300 feet) in summer, for occasionally they were noted in my diary; one July 16, within a mile of fort; one female adult September 21.

Maj. Thomas Elwood Rose saw three mule deer on Live Oak Creek, near the Pecos River, in Tom Green County, Texas, and killed two of them, in March, 1883. In 1893 a hunter named Patrick Keene told me that one winter some years previously a small herd of mule deer appeared near Brackettville, Kinney County, Texas, and that probably all were killed. No others had been seen in that region. In a letter from Dr. Paul Clendennin, dated Fort Davis, Texas, August 9, 1885, mule deer were spoken of as abounding in the mountains near Fort Davis, where he intended spending "the first week or ten days of September" of that year in hunting them. On the Mexican Line our first mule deer was killed at a horse ranch in the Sierra Blanca Mountains of southwestern Texas, and from that point to the San Luis Mountains (Monument No. 65) it was found near every station. Several large herds were found in the Potrillo, Camel, Seca, and Aguila mountains, March 19 to April 7, 1892. Some were killed in the mountains of New Mexico, near Mosquito Springs, in April and May, 1892. Others were shot at Dog Spring, New Mexico, at White Water, Chihuahua, and in the San Luis Mountains. West of the San Luis divide it was found in the Guadalupe Canyon, and as low as 1,133 meters, or 3,717 feet, in the San Bernardino Valley. None were seen west of the Huachuca Mountains. The species occurs in the Santa Rita and Santa Catalina mountains to the northward, and also about Tombstone.

The mule deer, in spite of its large ears and peculiar gait, is a splendid animal. In summer the does and their progeny of different ages form herds apart from the old males. At this season the horns of the bucks are soft, and a number may be seen associating amicably together, all in the reddish summer coat, and presenting a stirring spectacle as they go bounding through the open pine woods, clearing tree trunks and obstacles of any sort with prodigious bounds. In December the bucks fight fiercely with each other, their necks become greatly enlarged, and their flesh so strongly musky that it is scarcely fit for food. At all seasons, if wounded or at bay, the bucks will fight bravely with horns or feet.

Grass is not the principal food of the mule deer in Arizona. Grass is eaten, sometimes in large amount; but shrubs, leaves, and many small plants are more often eaten. It is extravagantly fond of acorns, especially those of the evergreen oak (*Quercus emoryi*). It usually feeds in the morning and evening, spending the hottest part of the day in the shade of a tree or rock. It is also apt to go to water in the evening or early morning, and, hunters say, on moonlight nights.

No wild animal of the region is so valuable to man as this deer, and especially to the Indian, whom it supplies with meat, clothing, shelter, and numerous utensils made from its skin, tendons, or skeleton. Its charred bones and various tools fashioned from the bones and teeth were usually found in the deserted buildings and cave dwellings formerly occupied by the extinct people known as the Cliff Dwellers, in the Verde Valley. Moccasins made from the neck skin of the mule deer are almost as good as those made from moose skin. Young mule deer make delightful pets. In the autumn of 1887, twin male fawns were presented to Maj. E. K. Otey at Fort Verde, Arizona, and immediately gained the friendship of the entire garrison. They were still in the spotted coat, and were fond of cows' milk, but ate a variety of food. One was brought to a Jersey cow whose calf had been taken away. The cow licked it affectionately and permitted it to suckle, which it did with alacrity. These fawns soon ate potatoes, turnips, sweet potatoes, watermelons, apples, mesquite beans, and, in short, almost any vegetable food, to say nothing of shavings, sawdust, scraps of paper, rags, and other rubbish. They were gentle, fawning like dogs on those they knew, and climbed upon one, with fore legs bent, to be petted. Full of curiosity, on entering a house they inspected every article of furniture and peered into every nook and cranny of the rooms. On seeing a dog, they stopped short, standing like statues, eyeing it intently. Their gait was always extremely graceful, whether trotting or bounding along at a run. They liked to rub their heads against those whom they knew well, and to climb up upon them as a dog does when asking to be petted; but they would butt and kick vigorously if strangers tried to pick them up or to carry them. Their voice was singular. When deserted by their friends they bleated quite loudly and looked for them in all directions. At first they made a low sound, like the squeak of a rat, that gradually increased in volume until it could fairly be called a bleat. When sleeping in the pine forest near Flagstaff, Arizona, in 1886, my "campaign" hat was pushed from my face early one morning and I beheld a large buck standing beside me. It was a tame mule deer that ranged at will about the town of Flagstaff.

In 1892, when the main supply camp of the International Boundadary Commission was located at White Water, Chihuahua, the watering place of a herd of mule deer, a buck came and drank its fill from the cook's water barrel, under a tent fly, in the midst of the large camp one morning at daybreak.

The Mexican cougar or mountain lion (*Felis oregonensis aztecus*) destroys great numbers of deer, and it is not uncommon to find the remains of deer that have been recently slain by it and hidden in caves or among shrubbery and rocks. In 1855, I found a large male mule deer that had been killed but a few hours before by a cougar. There were evidences of a severe struggle, which showed that the cougar—perhaps a small one—had encountered difficulties in the undertaking. On December 11, 1885, I found a deserted den of bears in a cave on Clear Creek. In it were many broken bones of deer and the fresh tracks of a cougar.

In the autumn of 1885 Messrs. Edward and Frank Jordan found a fat doe that had been killed by a cougar and covered with brush near their mining claim on Squaw Peak, one of the Verde Mountains.

Coyotes and other wolves follow the mule deer and drag down those that have been disabled by wounds or sickness; but they do much greater damage by destroying newly-born fawns that have been left hidden by their mothers. On several occasions I saw golden eagles, always in pairs, following herds of does and fawns; but I never saw them make an attack upon the deer, although I felt certain that they were following them with that object.

I have known but one case of the death of a mule deer from accident. On the wagon road from Fort Verde to Flagstaff, Arizona, on a high, juniper-clad mesa, I looked into a wonderful cave, in lime rock, beneath a layer of volcanic scoria, and could discern the horns and skeleton of a mule deer that had gotten into this pitfall, probably when the entrance was blocked with drifted snow.

When hunting a herd of frightened deer, near Fort Verde, the terrified creatures rushed over a vertical cliff, at the edge of a mesa, and disappeared. Looking over the edge, and expecting to see them all dead and mangled below, I was astonished to see the herd strung out along several narrow ledges, whence they all reached the bottom of the canyon in safety; and I am glad to say that not one of them fell to our guns. On another occasion, in the middle of July, 1884, when riding over a mesa only a mile or two east of Fort Verde, in the central part of Arizona, I came close upon a doe and little fawn that were lying in the shade of a red juniper tree. They sprang to their feet, looked at me an instant, and cantered to the edge of a deep canyon close by and disappeared. I rode instantly to the edge of the canyon, but the deer had already reached the bottom of it. It seemed incredible that they should have done so, as the canyon was deep, precipitous, and very rocky; and this fawn could not have been more than two months old. It was indeed a remarkable feat of agility. Having reached the bed of the canyon both stopped and gazed fixedly at me, then alternately trotted a little way and stopped to look. Riding along the bluff I startled them again and watched them gallop off a mile or more toward Beaver Creek.

When frightened, deer pay no heed to the sharp-spined cactus; and all that I have skinned have had cactus spines embedded in the tissues next to the bones of the limbs. These must cause pain, as before becoming encysted much inflammation is set up. Parasites also cause them much annoyance, and endanger their lives by affecting their sense of hearing and of smell. Ticks infest their ears, penetrating to the drum, and sometimes blocking up the external auditory canal. In one instance a dozen ticks were removed from the canal, where they had created an intense inflammation, the skin having peeled off entirely, leaving a red, inflamed surface. These ticks were preserved, and subsequently identified as the western cattle tick (*Ixodes bovis*) by Mr. William Beutenmüller. A large, grub-like larva,[a] measuring 25 by 10 mm. when not in motion, was found to be a very common parasite upon the nasal mucous membrane of this deer, in central Arizona. These parasites must be a source of almost intolerable suffering to the deer, beside rendering them an easy prey to their enemies.

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[a] The larva infesting the nasal cavity of the mule deer is of the family *Œstridæ*, possibly *Œstrus ovis* Linnæus, a parasite of the mucous membrane of the sheep. Another species (*Hypoderma tarandi*) infests the reindeer in like manner.

Cranial measurements of 11 specimens of Odocoileus hemionus canus.

Museum number.	Original number.	Sex and age.	Locality.	Date.	Total length	Greatest width.	Distance between orbits, taken opposite center.	Distance between pedicels of horns.	Nasal bones, greatest length.	Premaxillary bones from front to premolars.	Premaxillary bones from front to hinder margin of palate.	Length of maxillary tooth row. Upper molars, length taken together.	Distance between last upper molars.	Lower jaw, measured to end of coronoid process.	Lower jaw, from angle to end of coronoid process.	Length of mandibular tooth row.	Remarks.
			Odocoileus hemionus canus.		*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	
2154[a] 19567	277	♂ ad.	Ash Creek, Arizona	Nov. 9, 1885	279	133	81	65	83	90	173	80	.....	240	116	91	
2160[a] 19568	278	♂ ad.	.....do	.....do	293	132	76	67	98	93	176	79	52	250	115	93	
2157[a] 19569	282	♂ ad.	Fossil Creek, Arizona	Nov. 27, 1885	301	140	89	66	100	91	183	88	54	251	118	94	
2158[a] 1981	285	♂ juv.	.....do	.....do	282	125	83	65	92	95	180	87	49	242	111	98	A young buck with a single fork.
19570[a]	314	♂ ad.	Bakers Butte, Mogollon Mountains, Arizona.	Dec. 14, 1884	316	144	94	69	104	106	195	82	52	.....	.....	.....	
2168[a] 1975	283	♀ ad.	Fossil Creek, Arizona	Nov. 27, 1885	273	119	75	.....	87	88	168	88	52	232	115	87	
2169[a] 1976	284	♀ ad.	.....do	.....do	275	115	78	.....	87	86	168	80	48	239	109	89	
35841	1703	♂ im.	Carrizalillo Mountains		289	125	90	51	100	91	177	87	49	247	121	98	Second horns in velvet.
63145	1581	♀ ad.	Monument No. 15	Mar. 26, 1892	263	114	85	.....	79	83	165	82	46	225	106	93	Fully adult; premolars much worn.
63144	1580	♀ ad.	.....do	Mar. 23, 1892	283	114	92	.....	95	87	176	89	43	241	111	97	Dentition complete; youngish adult.
35749	1893	♂ im.	White Water, Mexico	June 21, 1892	287	122	92	52	86	93	176	80	47	238	114	89	Dentition mature; third horns in velvet.

[a] Collection of American Museum of Natural History, New York.

Dimensions and variations in the size and form of the horns in 20 specimens of Odocoileus hemionus canus from central Arizona.[a]

Original number.	Date.	Probable age.	Right or left horn.	A, B.	B, C.	B, D.	C, E.	C, F.	D, G.	D, H.	E, I.	E, J.	F, K.	F, L.	G, M.	G, N.	H, O.	H, P.	a, b.	o, o.	From burr to longest tip, in straight line.	From burr to longest tip, following curves of horn.	Circumference of burr.	Circumference A, B.	Circumference B, C.	Circumference B, D.	Greatest expanse of both horns.	B', B.	C', C.	D', D.
				mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*
315	Winter	Adult	Right	220	80	198	102	183	98	97	118	106	....	....	....	....	....	....	75	....	420	490	140	60	85	85	620	440	....	....
			Left	225	81	130	163	85	169	160	....	....	76	57	....	....	....	....	39	....	445	510	132	100	86	90				
282	November 27, 1885	do	Right	187	79	94	162	160	201	174	....	....	....	....	....	....	....	....	67	....	398	478	126	90	80	80	410	360	....	....
			Left	203	95	119	146	148	168	156	....	....	....	....	....	....	....	....	64	....	425	468	116	88	78	78				
316	Winter	do	Right	225	125	162	205	240	133	97	....	....	....	....	....	....	....	....	40	....	460	570	140	106	107	84	580	415	....	....
			Left	228	123	317	220	260	....	....	....	....	....	....	....	....	....	....	24	....	455	600	155	109	104	68				
278	November 9, 1885	do	Right	213	102	171	102	94	38	45	....	....	....	....	....	....	....	....	36	....	363	405	138	98	82	70	490	435	....	....
			Left	223	98	230	112	131	....	....	....	....	....	....	....	....	....	....	43	....	405	450	140	80	90	57				
277	do	do	Right	250	124	237	76	145	....	....	....	....	....	....	....	....	....	....	67	23	440	490	120	80	84	70	610	500	....	....
			Left	260	117	230	112	132	....	....	....	....	....	....	....	....	....	....	56	....	440	490	116	80	84	71				
314	December 14, 1884	do	Right	233	200	152	....	....	180	216	....	....	....	....	....	....	....	....	53	....	480	590	165	110	85	100	570	480	....	480
			Left	224	202	116	....	....	203	225	....	....	....	....	....	....	....	....	48	....	465	555	175	110	75	100				
285	November 27, 1885	Second year	Right	170	111	102	....	....	....	....	....	....	....	....	....	....	....	....	....	....	250	265	101	68	52	46	310	305	....	....
			Left	176	110	136	....	....	....	....	....	....	....	....	....	....	....	....	....	....	270	310	101	68	47	45				
384	March, 1886	Adult	Right	250	110	120	115	159	166	182	....	....	....	....	....	....	....	....	43	....	450	545	143	110	90	95	600	465	....	....
			Left	250	102	140	74	157	140	147	....	....	....	....	....	....	....	....	16	....	460	550	153	115	91	97				
385	do	do	Right	260	115	285	202	232	....	....	....	....	....	....	....	....	....	....	47	....	460	540	148	110	105	68	655	480	....	....
			Left	250	133	140	140	144	164	117	....	....	....	....	....	....	....	....	....	....	480	575	155	120	95	84				
386	March 7, 1886	do	Right	210	149	165	99	83	136	102	....	....	....	....	....	....	....	....	48	....	412	490	136	88	80	76	510	443	....	....
			Left	215	127	170	121	121	104	106	....	....	....	....	....	....	....	....	46	....	394	490	135	95	82	75				
410	January 12, 1885	do	Right	229	94	150	159	270	104	148	28	26	....	....	17	113	....	....	53	....	470	560	170	106	101	103	600	470	560	....
			Left	230	108	144	195	205	190	117	....	....	....	....	....	....	67	13	50	....	460	570	170	112	99	99				

411	March 7, 1886	do	Right	275	93	248	211	168	....	....	....	....	109	73	....	....	....	....	65	....	520	610	180	106	105	65	815	620	675	....
			Left	280	110	216	200	256	....	....	....	....	....	....	....	....	....	....	85	....	523	620	173	100	100	62				
412	July 2, 1886	do	Right	230	126	127	206	208	51	178	....	....	....	....	56	159	....	....	85	...	470	520	130	100	94	84	700	465	585	....
			Left	230	110	135	205	210	64	160	....	....	....	....	23	137	....	....	35	....	485	535	133	92	90	71				
413	Found in 1886	do	Right	265	120	190	99	142	102	144	....	....	....	....	....	....	....	....	61	....	493	560	155	108	98	83	630	525	....	540
			Left	265	138	168	40	90	131	169	....	....	....	....	....	....	....	....	83	....	480	595	153	101	87	88				
414	do	do	Right	217	106	208	194	200	107	94	....	....	....	....	....	....	....	....	75	....	437	510	130	91	87	80	580	473	....	500
			Left	235	112	170	183	140	100	105	....	....	....	....	....	....	....	....	80	....	405	500	125	90	86	72				
415	do	do	Right	225	112	272	150	148	....	....	....	....	....	....	....	....	....	....	68	23	410	500	135	89	88	72	565	445	540	....
			Left	218	108	293	163	183	....	....	....	....	....	....	....	....	....	....	53	....	432	515	138	88	84	70				
416	do	do	Right	210	115	150	120	110	150	183	....	....	....	....	....	....	....	....	....	....	477	580	138	92	84	79	627	530	....	580
			Left	260	102	165	100	107	100	160	....	....	....	....	....	....	....	....	....	....	482	580	135	90	87	78				
417	do	do	Right	220	100	150	184	221	175	155	....	....	....	....	....	....	....	....	33	....	490	515	140	87	84	77	585	420	515	....
			Left	208	95	143	205	233	205	158	....	....	....	....	....	....	....	....	16	....	485	535	140	91	86	77				
418	do	do	Right	225	110	160	159	196	200	185	....	....	....	....	....	....	....	....	69	....	495	565	165	96	95	87	565	443	....	465
			Left	222	103	150	153	188	215	200	....	....	....	....	....	....	....	....	72	....	490	565	160	97	90	84				
419	do	do	Right	158	180	143	....	....	135	12	....	....	....	....	....	....	....	....	22	....	333	420	110	76	59	64	347	320	120	....
			Left	170	190	222	....	....	...	...	....	....	....	....	....	....	....	....	38	....	312	425	110	73	58	63				

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[a] For explanation see fig. 25, p. 196

Record and measurements of 16 specimens of Odocoileus hemionus canus from central Arizona.

Museum numbers.[a]										From tip of nose to—							Fore limb.		Hind limb.			
Skin.	Skull.	Original number.	Sex and age.	Locality.	Date.	Nature of specimen.	Weight, pounds, avoirdupois.	Total length.	Tail from root to end of vertebræ.	Eye.	Ear.	Occiput.	Ear above crown.	Height above notch.	Girth of chest.	Distance between horns at base.	From olecranon process to end of hoof.	From radiocarpal joint to end of hoof.	From great trochanter to end of hoof.	From kneejoint to end of hoof.	From tibiotarsal (hock) joint to end of hoof.	Remarks.
					1885.			mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	
2162	....	161	♂ ad.	Mogollon Mountains, central Arizona.	Jan. 6	Fresh.	[b]106	....	190	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Tail and caudal vertebræ only preserved.
2163	....	162	♀ ad.	.....do.............	Jan. 8	....do.	[b]64	....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	The four legs and hoofs only preserved.
2155	....	167	♀ ad.	Fort Verde, Arizona.	Mar. 6	....do.	[c]70	....	.....	173	260	320	230	.....	.....	.....	.....	.....	.....	.....	.....	Head (skin and skull), one fore and one hind foot preserved.
2151	19567	277	♂ ad.	Ash Creek, Yavapai County, central Arizona.	Nov. 9	....do.	......	....	.....	165	255	315	220	200	.....	65	.....	.....	.....	.....	.....	Head and horns (skin and skull) preserved.
2160	19568	278	♂ ad.	.....do.............	....do...	....do.	......	....	.....	170	250	320	240	200	.....	95	.....	.....	.....	.....	.....	Skin of head and skull preserved.
2157	19569	282	♂ ad.	Fossil Creek, central Arizona.	Nov. 27	....do.	[d]128	1,750	175	175	285	350	250	200	950	65	640	345	955	730	480	Do.
2168	....	283	♀ ad.	.....do.............	....do...	....do.	......	1,620	175	175	260	300	230	190	810	.....	595	320	880	710	450	Do.
2169	....	284	♀ ad.	.....do.............	....do...	....do.	......	....	.....	175	260	310	213	193	.....	.....	.....	.....	.....	.....	.....	Do.
2158	....	285	♂ juv.	.....do.............	....do...	....do.	......	....	.....	180	275	310	240	210	.....	62	.....	.....	.....	.....	.....	Do.
2159	....	288	♂ ad.	Cherry Creek, Yavapai County, Arizona.	Dec. 9	....do.	......	....	.....	190	275	325	225	203	.....	70	.....	.....	.....	.....	.....	Do.
2161	....	295	♂ ad.	Sycamore Creek, Verde Valley, central Arizona.	Dec. 22	....do.	[e]175	1,780	230	185	265	340	280	220	960	60	665	370	970	845	490	Skull, skin, one fore and one hind leg.

2156	......	297	♀ ad	Fort Verde, Arizona.	Dec. 29	....do.	......	......	.....	167	248	290	230	195	.....	.....	.....	.....	.....	.....	.....	Skin of head, without skull.
......	19570	314	♂ ad.	Bakers Butte, Mogollon Mountains, central Arizona.	1884. Dec. 14	....do.	*d* 184	......	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Skull and horns, without lower jaw.
......	......	471	♂ ad.	Beaver Creek, Verde Valley, central Arizona.	1886. Nov. 19	....do.	*f* 145	1,780	184	178	255	330	255	223	980	.....	610	345	915	710	470	Skull and skin of head.
......	......	612	♀ ad.	Bakers Butte, Mogollon Mountains, central Arizona.	1887. July 26	....do.	*d* 105	1,670	160	180	265	325	217	207	900	.....	.....	.....	.....	.....	.....	Legs preserved.
2170	11140	620	♂ ad.	....do.	Aug. 3	....do.	......	......	225	185	280	340	223	203	950	.....	635	340	975	735	480	Skin and part of skeleton preserved for mounting. Four good-sized teats, and no testicles.

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[a] American Museum of Natural History.

[b] Weighed after evisceration, with head and feet cut off.

[c] Weighed after eviscerating and skinning, with head and feet cut off.

[d] Weight after evisceration and bleeding, with four feet cut off; live weight estimated at 150.

[e] Weight estimated.

[f] Weighed after evisceration, and hanging up several days.

Measurements of 6 specimens of Odocoileus hemionus canus.

U. S. National Museum number.		Original number.	Locality.	Date.	Sex and age.	Total length.	Tail to end of vertebræ.	Ear from crown.
Skin.	Skull.							
				1892.		*mm.*	*mm.*	*mm.*
	63144	1580	Monument No. 15, 49.6 miles west of the Rio Grande at El Paso.	Mar. 23	♀ ad.	1535	205	240
	63145	1581	.....do	Mar. 26	♀ ad.	1510	170	220
....		1592	.....do	Mar. 27	♀ ad.	1570	205	225
....		1605	Monument No. 15, 49.6 miles west of the Rio Grande at El Paso.	Mar. 30	♀ ad.	1510	190	212
....		1606	.....do	....do...	♀ ad.	1370	228	220
20570	35749	1893	Near Monument No. 61, White Water, Chihuahua, Mexico.	June 21	♂ im.	1630	225	240

U. S. National Museum number.		Original number.	Locality.	From tip of nose to—			Forelimb from olecranon to end of hoof.	Length of manus.	Hindlimb from knee-joint to end of hoof.	Length of pes.	Height of animal at shoulder.	Height of animal at hips.
Skin.	Skull.			Eye.	Base of ear.	Occiput.						
				mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
	63144	1580	Monument No. 15, 49.6 miles west of the Rio Grande at El Paso.	190	260	310	603	330	710	464	950	1050
	63145	1581	.....do	180	290	320	580	310	660	450	910	1010
	....	1592	.....do	167	280	300	580	310	715	450	900	1000
	....	1605	Monument No. 15, 49.6 miles west of the Rio Grande at El Paso.	170	280	300	570	320	650	450	900	950
	....	1606	.....do	153	245	275	550	315	630	430	910	975
0570	35749	1893	Near Monument No 61, White Water, Chihuahua, Mexico.	178	255	320	582	325	730	480	920	1010

ODOCOILEUS HEMIONUS EREMICUS (Mearns).

BURRO OR DESERT MULE DEER.

Dorcelaphus hemionus eremicus MEARNS, Proc. U. S. Nat. Mus., XX, p. 470, Dec. 24, 1897 (p. 4 of advance sheet issued Feb. 11, 1897; original description).

Odocoileus hemionus eremicus, THOMPSON, Forest and Stream, LI, Oct. 8, 1898, p. 286.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, 1901, p. 16 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Odontocœlus hemionus*] *eremicus*, ELLIOT, Field Col. Mus., Zool. Ser., IV, Pt. 1, 1904, p. 77 (Mam. Mid. Am.).

Bura, W J McGEE, The National Geographic Magazine, VII, Apr., 1896, p. 130. The fauna of Seriland includes the bighorn and bura (a large sluggish deer), *Cuerro* of the Mexicans.

Type-locality.—Sierra Seri, Sonora, Mexico, and region around the head of the Gulf of California.

Geographical range.—Deserts and desert ranges of the Western Desert Tract; both sides of the Colorado River and around the head of the Gulf of California, occupying the Lower Sonoran Life Zone. It occurs on Tiburon Island.

Description.—A large deer. Mr. H. von Bayer shot a buck, supposedly of this form, on Tiburon Island, in the Gulf of California, which weighed 120 pounds avoirdupois when dressed. A number of these deer were shot for food by members of the surveying parties; but, unfortunately, I was not present to measure and preserve them as specimens, though I sometimes saw some of the deer alive when hunting in the Nariz and Quitobaquita mountains. On this account the materials for description were fragmentary and unsatisfactory. I was indebted to Dr. W J McGee, then of the Bureau of Ethnology, for a single skin of this deer. This specimen (No. 63403, U.S.N.M.), an adult male in full winter pelage, was taken by Doctor McGee on an expedition to Seriland, in the Sierra Seri, near the Gulf of California, in December, 1895. The locality is in the most arid portion of Sonora, Mexico. Like all mammals of this Western Desert Tract it is remarkable for the extreme pallor of its coloration. The coat is short and glossy. Upper parts very pale drab gray, with a dark vertebral area, which begins as a narrow median stripe on the upper side of the neck, broadens and becomes fainter on the back, forms a blackish spot at the root of the tail, down which it descends for a short distance. The buttocks, inguinal and abdominal regions, and the middle of the tail all round are white. The axillæ and hollows of the thighs are entirely naked. The edges of the buttocks, posterior surface of limbs, and the feet are washed with pale, muddy cinnamon. The chest is light sooty drab. Tail with a heavy brush or short switch of black hair at the tip, the middle portion being white all round, the dusky color extending a short distance downward, on the upper side, from the blackish spot at its base. While the general effect is to produce a pale drab-gray coloring of the upper surface, there is the usual pepper and salt commingling of colors, produced by light and dark annulation of the hairs, those of the vertebral area being pointed with brownish black.

There is no complete skull for description. The horns are very characteristic. They are heavy and very divergent, being chiefly remarkable for the great length of the beam before forking. In a youngish specimen from the Cerro Salado in the Sonoyta Valley (No. 59910, U.S.N.M.), the distance from the burr to the first fork, following the curve of the beam, is 320 mm. The total expanse of this pair of horns is 620 mm. They are doubly dichotomous throughout, having four points, besides a basal snag on each horn. Referring to the diagram on page 196, detailed measurements are as follows: A B 290 mm., B C 180, B D 192, C E 72, C F 54, D G 47, D H 67. Another pair (No. 60855, U.S.N.M.) belonged to a fully adult animal, killed at Black Butte, on the Colorado Desert near the "volcanoes" or mud geysers, Lower California (fig. 26). This was from one of six deer that were killed by Mr. Samuel Cameron, one of our guides, during the winter of 1893–94. The beam is unusually stout and has a length of 310 mm. before forking, and the horns have a total expanse of 775 mm. The horns, which are also doubly dichotomous, measure in detail: A B 320 mm., B C 130, B D 140, C E 175, C F 130, D G 163, D H 117.

Habits and local distribution.—The burro deer of the Western Desert Tract probably occurs in all suitable localities—where it can obtain food and drink. Indians and Mexicans speak of it as the "burro," or simply "cuervo." When with the Monument Building Party, following the main portion of the survey, I saw two on level land near the base of a mountain near Pozo de Luis, Sonora, Mexico. It was quite common in the mountains (Santa Rosa, Sierra de Sonoyta, Cerro Salado, and Sierra de Quitobaquita) near Sonoyta, Sonora, and many horns were exhibited on the huts of the Papagoes. January 9, 1894, I shot at a fine buck on Nariz Mountain, where weathered horns were also seen. Bones and its peculiar horns were frequently seen on both sides of the International Boundary in the hills surrounding Quitobaquita, Pima County, Arizona. Tracks and remains were noted about Gardners Laguna and Indian Wells, on the Colorado Desert. Farther south, in Lower California, the species occurs in large herds, during the winter season, and is known by the inhabitants to be different from the "black-tailed deer" of the mountains of the coast.

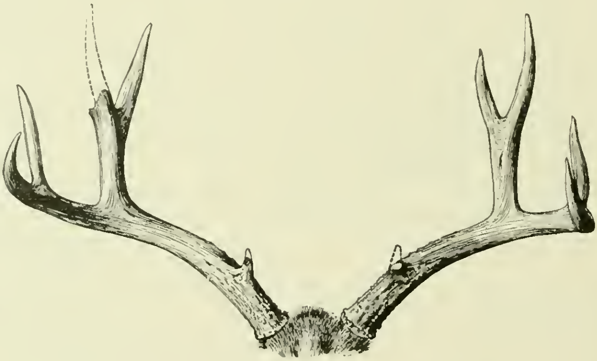

FIG. 26.—ANTLERS OF ODOCOILEUS HEMIONUS EREMICUS. (Cat. No. 60855, U.S.N.M.)

Specimens collected.—Three sets of bones, besides the skin, were presented to the U. S. National Museum by Doctor McGee.

ODOCOILEUS HEMIONUS CALIFORNICUS (Caton).

CALIFORNIA MULE DEER.

Cervus macrotis var. *californicus* CATON, Amer. Nat., X, Aug. 1876, p. 464.

Odocoileus hemionus californicus, THOMPSON, Forest and Stream, LI, Oct. 8, 1898, p. 286.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, 1901, p. 16 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Odocoileus hemionus*] *californicus*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 43 (Synop. Mam. N. Am.).

[*Odontocœlus hemionus*] *californicus* ELLIOT, Field Col. Mus., Zool. Ser., IV, Pt. 1, 1904, p. 77 (Mam. Mid. Am.).

Type-locality.—Near Gaviota Pass, 40 miles from Santa Barbara, California.

Geographical range.—Sonoran and Transition zones of the Pacific Coast Tract. California and Lower California.

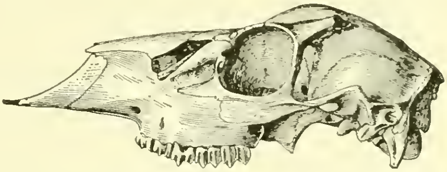

FIG. 27.—ODOCOILEUS HEMIONUS CALIFORNICUS. SKULL OF YOUNG MALE. (Cat. No. 60906, U.S.N.M.)

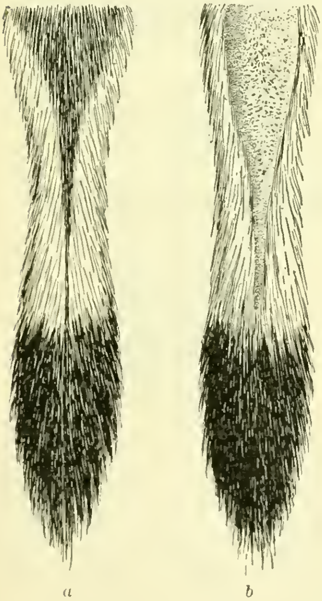

FIG. 28.—ODOCOILEUS HEMIONUS CALIFORNICUS. *a*, TAIL, UPPER SURFACE. *b*, TAIL, UNDER SURFACE.

Description.—A large deer, which, at first sight, appears to be very distinct from other members of the group; but specimens in the U. S. National Museum show intermediate characters suggesting intergradation with the forms living to the eastward. A male (No. 60906, U.S.N.M.) killed May 28, 1894, near the summit of the Coast Range Mountains, at Monument 231, by Jeremiah E. Crabb, blacksmith, was in nearly complete summer pelage, only retaining the grayish winter hair on the hinder part of the rump, bordering on the white of the buttocks, and scattered tufts of hair on the neck, back, and sides. General color of upper parts vinaceous cinnamon, becoming more yellowish on the limbs, and darker on the back from the presence of black tips to the hairs. The head is fawn color on sides, gray on base of ears and on muzzle anterior to the eyes. The edges of the lips, end of chin, and middle of throat are white. The end of the muzzle, around the naked muzzle and nostrils, is black; and there are three black spots on the underjaw, one on each side in front of the angle of the mouth, and one in the median line near the end of the chin. The ears are coated within with long, curled, whitish hairs, and are gray externally, with the anterior border and tip broadly black. Eyelids and crown of head, black. The chest is sooty, and the belly white. The tail (fig. 28) is naked on the inner surface for one-third its length; color white at base, with a black terminal brush, and but faint traces of the colored line on its upper side, which is often plainly marked in this deer. In this individual there is no distinct vertebral stripe. The horns, which were just starting, measure 30 mm. in length. Metatarsal gland (fig. 29) 75 mm. in length; the tuft of hair in which it lies, 125.

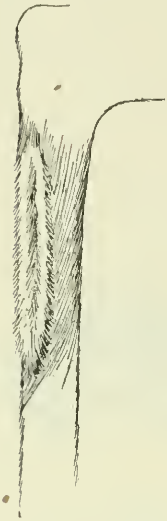

Fig. 29.—Odocoileus hemionus californicus. Metatarsal gland. (Cat. No. 60906, U.S.N.M.)

Specimens examined later in the season were redder, with less sooty on the chest, the color deepening to cinnamon rufous on the back, becoming paler on the head, neck, and limbs. Both summer and winter skins had the dark vertebral line. Near the Pacific coast, this deer has smaller ears than in the interior, near the desert; and in summer its color is redder. A herd seen near the last Monument (No. 258) was almost as red as the range cattle feeding near them. The blackish areas found on the mule deer of the interior region of the continent are much more intense in the Pacific-coast form. The crown of the head, much of the ears, and a vertebral stripe are usually very black. When the dark vertebral line is plainly marked, it is usually prolonged on the upper side of the tail (fig. 28), connecting with the black terminal brush. The tail is composed of nine short vertebræ, *Odocoileus couesi* having eleven much longer ones. *Odocoileus hemionus californicus* has the longest tail of any form of the group known from the Mexican Border. Those from the desert side of the Coast Range often lack the black line on the upper side of the tail, and their paler colora-

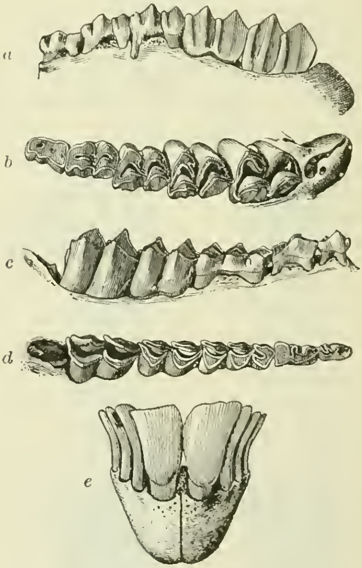

Fig. 30.—Odocoileus hemionus californicus. Teeth of young male. (Cat. No. 60906, U.S.N.M.) *a*, Profile of right upper molar series; *b*, crowns of right upper molar series; *c*, profile of right lower molar series; *d*, crowns of right lower molar series; *e*, incisor-canine series, front view.

tion and much larger ears point to intergradation with *Odocoileus hemionus eremicus*.

The characters of the skull are shown in fig. 27 and of the teeth in fig. 30.

Measurements.—The only specimen measured fresh (No. 60906, U.S.N.M., described above), presented the following dimensions: Total length in a straight line, 1,325 mm.; tail vertebræ, 200; tail to end of switch, 300; ear from crown, 223; ear from notch, 192; width of ear, 123; distance between eyes, 108; diameter of eye, 22; distance from tip of nose to angle of mouth, 78; nose to eye, 144; to center of pupil, 160; to base of ear, 233; to tip of ear, 465; distance from shoulder to hip along side, 630; height at shoulder, 630; height at hip, 965; fore limb from olecranon, 557; length of manus, 312; hind limb from knee joint, 665; length of pes, 435.

Genus CERVUS Linnæus (1758).

Cervus LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 66.

Type.—*Cervus elaphus* Linnæus.

Characters.—Size, large; skull as in the *axine* group; without ridges on frontals; supporting large antlers (only in the male) on osseous pedicels; antlers with the beam rounded, splitting up near the summit into a larger or smaller number of snags, often arranged in a cup-like manner, and with a brow tine always present.

CERVUS MERRIAMI Nelson.

MERRIAM ELK.

Cervus merriami NELSON, Bull. Am. Mus. Nat. Hist., N. Y. XVI, Jan., 1902, pp. 1 to 12, figs. 1 to 7 (original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXXI, No. 3, Aug. 27, 1903, p. 69. (Syst. Results Study N. Am. Mam. during the years 1901 and 1902).

Type-locality.—Head of Black River, White Mountains, Apache County, Arizona. Altitude, about 9,000 feet.

Geographical range.—Upper Transition and Boreal zones in summer, descending to the Lower Transition and Upper Austral zones in winter, in the mountains of western New Mexico and eastern Arizona, probably crossing to the high mountains of northeastern Sonora, Mexico.

Description.—The following essential data are taken from Mr. Nelson's original description, tabulated comparative measurements of the skull, teeth, and horns, as well as other portions of the description and comparisons, being omitted:

"*Type*, No. 111639, . ad., U. S. National Museum, collected August, 1886, at head of Black River, White Mountains, Arizona, by E. W. Nelson.

"*Distribution.*—Formerly all of the higher parts of the White Mountains of Arizona and the Mogollon Mountains of western New Mexico. Now nearly extinct and limited to a small area in the higher parts of the White Mountains (and possibly the Mogollons).

"*General characters.*—Nose darker and head and legs more reddish than *Cervus canadensis* from the northern Rocky Mountains, but paler than *C. roosevelti* Merriam, of the Northwest Coast Region. Skull more massive with nasals broader and much more flattened, and upper molar series heavier and more curved. Antlers most like those of *C. canadensis*, but with tip straighter, thus giving much longer chord from base to tip.

"*Summer pelage* (type specimen).—Top of nose rich reddish chestnut brown becoming much paler and more yellowish along edges of upper lips; and paler, more reddish fulvous on cheeks, forehead, and crown; pale areas around eyes dull dark buffy; chin dingy buffy with large blackish brown spot on each side; front of ears pale buffy yellow; back of ears reddish brown; top of neck, entire back and sides of body faded grizzled yellowish brown, darkest along middle of back and shading into pale dingy yellowish on flanks; rump patch dingy yellowish white (not strongly contrasting with rest of back) bordered along lower edge by narrow band of seal brown; underside of neck and body dark brown, darkest on neck and more reddish on belly; front of forelegs dark reddish brown becoming paler (nearly vandyke brown) on sides and with median line behind and around borders of hoofs reddish fulvous; hind legs similarly colored but paler along front.

"*Winter pelage.*[a]—'Body, above and on sides, pale yellowish brown, this color extending over entire outer surfaces of shoulders and hips and over all of buttocks and tail. Head and neck seal brown with pale areas around commissure and eyes; ears whitish at base and liver brown on posterior surfaces. Sides of neck paler than underside of head and neck, the hairs being dark brown at base with broad fulvous tips and brown annulations. Under surface of body, with inner and posterior surfaces of legs, dark seal brown, a band of the same color extending upward and outward from inside of thighs toward hip joint. Front and outside of legs cinnamon-rufous, varying to fulvous. Hoofs black with fringe of buff-colored hairs at base.'

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[a] "Dr. E. A. Mearns, U. S. A., has kindly given me the accompanying description of the winter pelage of *Cervus merriami*, taken from the skin of No. 16211, American Museum of Natural History. This specimen was secured by me in the White Mountains in the fall of 1887, and passed into the hands of Dr. Mearns, who afterwards presented it to the American Museum of Natural History. Fortunately, Dr. Mearns entered a brief description of the pelage in his note book at the time, as the skin has since been accidentally destroyed." [Footnote by Nelson.]

"*Skull.—Cervus merriami* has strongly marked skull characters. It differs strikingly from both *Cervus canadensis*, of the northern Rocky Mountains, and from *Cervus roosevelti*, of the Northwest Coast, in having the nasals remarkably broad and flattened; the palate narrow between the posterior molars and in the great zygomatic breadth and massive molars."

Measurements.—Cranial measurements of adult male (No. 16211, Am. Mus. Nat. Hist.) topotype, from the White Mountains, near Springerville, Arizona: Occiput to front of premaxillæ, 498 mm.; palatal length, 288; length of nasals, 183; greatest breadth of nasals, 83; greatest orbital breadth, 194; greatest breadth across premaxillæ, 99; breadth across parietals, 168; zygomatic breadth, 203; breadth below lachrymal fossæ, 157. (From Nelson.)

Measurements of upper molar series (No. 16211, Am. Mus. Nat. Hist.).—Total length of row, 137 mm.; distance between alveoli: 1st P. M., 59; 2d P. M., 63; 3d P. M., 75; 1st M., 77; 2d M., 76; 3d M., 69; breadth of 2d M. at base, 31. (From Nelson.)

Measurements of antlers (No. 16211, Am. Mus. Nat. Hist.).—Chord from bur to tip, 1,067 mm.; distance along outside of curve, 1,240; circumference above bur, 237. (From Nelson.)

"The Arizona Elk, the last of the large game mammals of America to become known to science, is already on the verge of extinction. So far as I have been able to learn, its range has been long isolated and in an area where the idea of game protection is very recent, and where even now the protection afforded by the game laws (owing to the remote situation) is more nominal than real. The present game law of Arizona prohibits the shooting of elk at all seasons, and it is to be hoped that an effort may be made to render this protection effectual.

"The only specimens of this species now known are the two obtained by myself near the head of the Black River in the White Mountains of Arizona. The type is in the National Museum, and the other specimen, represented by the skull and antlers of an old male, is in the American Museum of Natural History. The skull of the American Museum specimen is described and figured in this paper, owing to the temporary mislaying of the skull of the type [which is now in its place in the U. S. National Museum collection].

"I have found no published record of this species among earlier authors, and the actual extent of its former range will be difficult to determine. My first knowledge of its existence was obtained in the fall of 1882, when some prospectors at Chloride, New Mexico, told me that elk inhabited the Mogollon Mountains near the extreme headwaters of Gila River. Nothing further was heard of it until the early months of 1884, when I spent some time in exploring the Indian ruins about the village now called Frisco, on the headwaters of the

San Francisco River in western Socorro County, New Mexico. During January I made a horseback trip about 10 miles to the eastward into the border of the Mogollon Mountains and saw a doe elk and two young bucks hanging by a hunter's cabin. At this time elk were reported to be not uncommon on the higher parts of the range, but the total number, from all accounts, must have been very small compared with those then found in Colorado and farther north.

"From 1885 to 1887, while living on my ranch at the eastern base of the White Mountains, near Springerville, Arizona, I heard frequently of elk living in the higher and more remote parts of these mountains, mainly along the border of the White Mountain Indian Reservation, near the head of Black River (a tributary of the Gila). The local hunters reported them as not uncommon in this area where, during brief hunting trips between 1885 and 1888, I saw signs of their presence in various places. Their main range covered an area about 30 by 50 miles in extent, at an elevation from 8,000 to 10,000 feet above sea level. This country forms the divide between the headwaters of the Little Colorado River and Black River and the high Prieto Plateau between the upper Black River and Blue River. At the time of which I write elk were far from numerous, but I never visited their territory without seeing signs, usually more or less recent tracks, and in fall the broken branches and barkless trunks of saplings, where the bulls had been rubbing their horns. The most abundant signs were found about some beautiful damp meadows in the midst of the dense fir forest on the rolling summit of the Prieto Plateau, between the Blue and the Black rivers. Owing to the presence of hostile Apaches at that time, it was dangerous to linger in the country where we saw most of the elk signs, so we always pressed on to a safer district before doing much hunting. Outside the Indian country they were not common enough for one to hunt them with any degree of certainty. From 1884 to 1889 the white hunters did not kill a dozen elk in all this district.

"Mr. W. W. Price, who made a collecting trip for mammals through the White Mountains during July and August, 1894, states: 'So far as we could learn this animal is now confined to a small area in the higher White Mountains. Several were seen and a fine male was shot at about 9,000 feet elevation on August 10. They feed in the dense fir woods and glades which clothe the upper slopes of the mountains.' (Bull. Am. Mus. Nat. Hist., Vol. VII, 1895, pp. 257, 258.) A recent letter from my brother, Mr. F. W. Nelson, informs me that a local hunter found the trail of a bull elk near the head of Black River the present autumn (1901), and followed it for two days without obtaining a shot at the animal. This shows that the Arizona elk still survives, and that it is pursued by local hunters regardless of the legal prohibition." (*E. W. Nelson.*)

Habits and local distribution.—Among my notes referring to this species I find a copy of a letter dated Fort Verde, Arizona, March 29, 1888, addressed to Dr. J. A. Allen, containing the following:

> Box No. 10 should be unpacked, and the skulls in it put away without unwrapping. In it is the skin of a fine adult male elk, taken by E. W. Nelson, in the White Mountains, Arizona. Mr. Nelson generously placed the specimen at my disposal for just what it cost him to transport it out of the woods ($25). It cost me six dollars ($6) to get it from his place to Fort Verde, making a total cost of $31. The horns are different in shape from any others I have seen. The head is in another box (No. 11), to be sent with the next lot. I think it will make a nice specimen for mounting; and I will present it to the Museum for that purpose. If it can be mounted soon I will be able to describe it better when I reach New York. The elk has become so scarce in Arizona that I think it doubtful whether other specimens will be preserved from this Territory. A small number still reside in the White Mountains, ranging in a very limited area. There are no others in Arizona. I explored their late stronghold in the region about San Francisco Mountain very thoroughly last summer without finding other evidence of its previous existence than a few fragments of very old horns. It is thought to be entirely extirpated from there by the hunters. None have been seen alive for several years; and they would have been seen if any were there.

Of four letters now before me, received from Mr. Nelson and containing references to the elk skin, which he finally forwarded from St. Johns, Arizona, January 7, 1887, only the first, dated Springerville, Arizona, January 24, 1886, contains data of interest, as follows:

> A party of five made a hunt this fall around the base of "Baldy" (Mount Ord), across Black River on the reservation; thence across the Blue Range to the Blue River, about 20 miles above its junction with the San Francisco River, and thence home [to Springerville]. We were in a very rough country with not much game. We got deer (black and white tailed), one elk, two black bears, and some turkeys. Would you like a description of the elk, a fine 4-pronged buck in new winter fur? A fine 6-prong buck in the velvet I sent to Washington last August. It was shot in June. Elk are becoming very scarce here now.

He next referred to the elk skin (No. 16211, Am. Mus. Nat. Hist.), April 10, 1886, as follows:

> It is a fine 4-pronged buck in prime winter fur, and the skin is in good mountable condition.

Later, Mr. Nelson very kindly sent me the following:

ELK NOTES.

> A few years since, the elk was comparatively numerous in the White Mountains of this Territory and was most plentiful on the eastern slope of this group.
>
> The flanks of "Baldy," or Mount Ord, as it is marked on the maps, and the country about the heads of Black River formed their summer resort. In winter they followed down Black River, where a lower altitude gave them a milder winter climate. At this season, as at present, they did not seek to leave the snow, but merely found a level where the snow was not so heavy as in the high summer country. The last five or six years has nearly exterminated them in these mountains. The country has been settled by cattle ranchers

and squatters, and all have made war alike upon the large game. During the last two years only four elk have been killed on the eastern slope of the White Mountains and on Black River. In the fall of 1885 I found a few elk signs in the spruce thickets on the summit of the Blue Range, which separates the Black from the Blue River. Some small trees with the bark rubbed off showed where the bull elks had rubbed the velvet from their horns in summer, so a few must remain there yet at that season.

In January, 1884, during a trip through the Nigrita Mountains in New Mexico, on the Nigrita Creek, one of the headwaters of the San Francisco River, I saw a cow and calf elk hung before a hunter's cabin and was told that at the beginning of winter a band of seven elk had been found in these mountains and had been hunted until only two remained alive at the time of my visit, and they expected to get these before spring. The hunters had crossed the mountains in every direction, and the members of the band mentioned were said to be the only ones in these mountains.

They were formerly abundant in these mountains and on to the east through all of the high Mogollon Range in New Mexico.

In the White Mountains of Arizona the elk have their rutting season in October and November. At this time the bulls travel much during the night. In October, 1884, one passed close by my camp, on the head of Black River, one night, giving a hoarse bellow every half mile or so.

Their horns are shed in February or March and by the end of the following June are full grown again.

The middle of June, 1885, I obtained a fine full-grown set of six pointed antlers in the velvet. In August and September the velvet is shed.

The calves are born in May and June. The curious and at times unaccountable stupidity of this animal renders it very often an easy prey to the hunter. In one instance a cowboy riding about the head of Black River came upon a small park in which a cow elk and her calf were feeding, and riding quietly to the edge of the trees with his rope in hand he made a sudden dash and before the elk could make up their minds to get out of the way he had the calf roped and took it home with him.

It was readily tamed, but was killed accidentally some weeks later. The hunter who obtained the antlers in the velvet for me found the elk asleep in a dense growth of ferns behind a log. The hunter's attention was first drawn to the spot by seeing the tops of the antlers as they swayed slowly back and forth over the ferns. Walking cautiously up to the side of the log and only about 20 feet from the elk the hunter stamped heavily upon the ground with one foot. The elk at once reared its head above the ferns and was killed by a shot through the brain. All the antlers I have seen in this region are much smaller, and less robust, or more slender than those I have seen in Colorado and from other northern points. Like the deer, the elk of this region is smaller than are those found farther north. The favorite resorts of these animals are portions of the mountains where dense thickets of spruce or other trees give good shelter in close proximity to open parks and streams of clear, cold water. Brook trout are numerous in these streams, and it is a curious fact that the range south of the elk is, so far as I have ascertained, coincident with that of the mountain trout, the true *salmo*.

The interesting book, by Maj. John G. Bourke, entitled On the Border with Crook (2d ed., 1892), contains several references to the Arizona elk, among them the following:

> It was through the country of the tribes to the south that the Spaniards first were brought face to face with the "Tinneh" of Arizona, and it was from these

> Maricopas and others that the name was learned of the desperate fighters who lived in the higher ranges with the deer, the elk, the bear, and the coyote (p. 113). * * * The Apache was not so well provided with meat as he might have been, because the general area of Arizona was so arid and barren that it could not be classed as a game country; nevertheless, in the higher elevations of the Sierra Mogollon and the San Francisco there were to be found plenty of deer, some elk, and, in places like the Grand Canyon of the Colorado, the Canyon of the Rio Salado, and others, there were some Rocky Mountain sheep. Down in the plains or deserts, called in the Spanish idiom "playas" or "beaches," there were quite large herds of antelope, and bears were encountered in all the high and rocky places (p. 129).

Writing of the vicinity of Camp Apache, Arizona, he observes:

> Two branches of the Sierra Blanca River unite almost in front of the camp, and supply all the water needed for any purpose, besides being stocked fairly well with trout, a fish which is rare in other sections of the Territory. Hunting was very good, and the sportsman could find with very slight trouble deer, bear, elk, and other varieties of four-footed animals, with wild turkey and quail in abundance. * * * The Tonto Basin was well supplied with deer and other wild animals (p. 142).

In October, 1884, during a "pow-wow" with the head men of a small tribe of Apache Indians then living on Carrizo Creek, Arizona, General Crook pointed to an old Indian and said:

> That man is a great hunter. He used to kill many elk in the White Mountains.

The remark was repeated to the hunter through an interpreter, and he was much pleased that the General remembered him so well. Elk teeth were quite commonly seen in the possession of the Apaches.

Through conversation with hunters, I noted, October 3, 1884:

> The elk is still to be found in considerable numbers in the White Mountains of Arizona, and in less numbers in the San Francisco Mountain region.

I found charred bones of the elk in the ancient buildings reared by the now extinct cliff dwellers of the Verde Valley. I did not see the elk in the Southwest, but saw the tracks of an old bull on Oak Creek, Arizona, when hunting with Sergeant Fox, in the winter of 1885–86. At the head of this stream, in the San Francisco Mountains, a few fragmentary old cast horns were discovered by members of my party in 1887. Not an elk was then known to exist in that region. Mr. "Bill" Munds, an old settler who owned a handsome herd of stock and a fine range in the San Francisco Forest, told me that when he first came into Arizona, many years ago, he found the Indians making a "drive" of elk in the San Francisco region. There were plenty of elk tracks and more of Indians', although he saw neither elk nor Indian on that day; but there was abundant evidence that the drive was successful.

The Hopi Indians called the elk *Chyze'-ze-scha*. One of the Hopi, when shown the skin of the elk sent me by Mr. Nelson, called it "*El-k*," and said that very few remained (in 1887) anywhere near the Hopi country, but that his brother had killed one in the White Mountains of Arizona.

Late in October, 1892, the cook of one of the surveying parties, a man who had never lived in the West before and who had not even heard of the elk, but who had shot, skinned, and become thoroughly familiar with the mule deer while with the survey, came to camp and told with much excitement of two huge deer with enormous antlers that he had just seen on San Jose Mountain, Sonora, Mexico. He had started them when too far off for a successful shot, and was unable to overtake them. Soldiers who went with this man the next day were quite certain that the tracks were those of elk, and I have no doubt that they were, as the cook gave an accurate account of this animal without any earlier knowledge of its existence. I had previously and have subsequently thoroughly explored these mountains without seeing any signs of elk. The two mentioned were possibly migrating to the neighboring Sierra Madre Mountains in Mexico.

Family ANTILOCAPRIDÆ.

PRONG-HORN ANTELOPES.

Closely allied to the *Bovidæ*, but the horns deciduous and branched. (*Flower* and *Lydekker*.)

Genus ANTILOCAPRA Ord (1818).

Antilocapra Ord, Journ. de Physique, LXXXVII, 1818, p. 149.

Dentition.—I. $\frac{0-0}{3-3}$ C. $\frac{0-0}{1-1}$ P. $\frac{3-3}{3-3}$ M. $\frac{3-3}{3-3}=32$.

Type.—*Antilope americana* Ord.

Characters.—Bony horn cores unbranched, forming vertical, bladelike projections immediately above the orbits (fig. 33); horns compressed, about 250 mm. in length, in a straight line, or 400 mm. following the curves, having a gentle backward curvature, the short

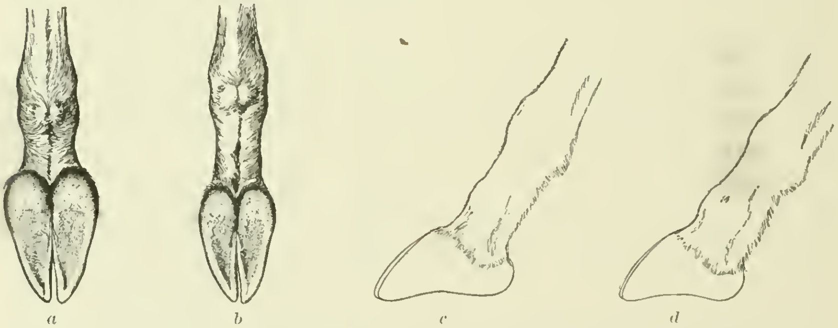

FIG. 31.—ANTILOCAPRA AMERICANA MEXICANA. *a* AND *c*, FOREFOOT; *b* AND *d*, HINDFOOT.

branch or prong arising about the middle of its height. When the horn is about to be cast off, it becomes loosened and a new one covered with long hairs, which soon disappear, is formed upon the bony core beneath it. The ears are long and pointed. Tail short and pointed, densely coated with coarse hair, except on the underside where the hairs are extremely short. (Fig. 32.) The neck has a thick mane of long chestnut-colored hair. Accessory hoofs are wanting. (Fig. 31.) The lachrymal sinuses of the true antelopes are undeveloped; as also are the "inguinal pores," or groin sacks found in true antelopes.

ANTILOCAPRA AMERICANA MEXICANA Merriam.

MEXICAN PRONG-HORN ANTELOPE.

Antilocapra americana mexicana MERRIAM, Proc. Biol. Soc. Washington, XIV, p. 31, Apr. 5, 1901 (original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXXI, No. 3, Aug. 27, 1903, p. 71 (Syst. Results Study N. Am. Mam. during the years 1901 and 1902.).

[*Antilocapra americana*] *mexicana*, ELLIOT, Field Col. Mus., Zool. Ser., IV, Pt. 1, 1904, p. 82, pl. XXXII (Mam. Mid. Am.).

An uhl' of the Hualapai Indians of north-central Arizona.

Chur-rae' of the Hopi Indians of northeastern Arizona.

Type-locality.—Sierra en Media, State of Chihuahua, Mexico.

Geographical range.—Sonoran and Transition Zones of northern Mexico, extending north into the United States, along the Mexican border. Its vertical range extends from below sea level (on the Colorado Desert, California) 2,500 meters (8,250 feet) on San Francisco Mountains.

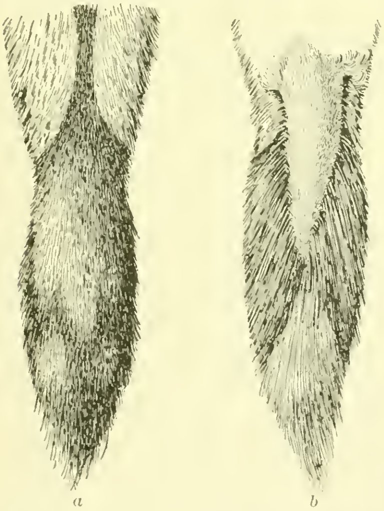

FIG. 32.—ANTILOCAPRA AMERICANA MEXICANA TAIL. *a*, UPPER SURFACE; *b*, LOWER SURFACE.

Description.—The antelope's coloring is made up of white and fawn color, with some blackish markings on the head. On the body, the white occupies all of the under surface, and extends to the inner aspect of the limbs, extending well up on the sides of the body, where it forms a rectangular area, between the shoulders and hips. The whole rump is white, with the exception of a narrow median strip of fawn color that usually connects the colored area of the upper side of the tail with that of the back. The lips and chin are white, as are areas on the cheeks, throat, and inner surface of ears, besides which the underside of the neck is beautifully marked with a white crescentic area above, and a white shield-shaped area below. The fawn color occupies the back and most of the neck, extending down the outer side of the limbs and encircling them low down, and backward in a narrow line, dividing the rump and ending on the upper side of the tail. This color becomes more tawny on the neck, and the elongated hairs forming the main are russet, tipped with black. The upper side of the head, which varies from creamy white on the sides to wood brown or even tawny-fawn color above, is strongly marked with brownish black in the male, and there are whitish areas around the horns and at the base of the ears. The black markings are much more extensive in old males than in young or female individuals. In old bucks of *Antilocapra americana americana* the black sometimes occupies the whole face in front of a line connecting the horns, but, in most cases, an oval fawn-colored space is inclosed. In *Antilocapra americana mexicana* the black becomes dark brown and only occupies the end of the muzzle and a narrow space in front of the horns, much as in northern females, leaving the middle of the upper side of the head wood brown. In both forms the eyelashes are jet black, and there is a black listing on the edges of the ear, apically, and a black spot—in the male—occupying the side of the head below the angle of the jaw; the latter a sex mark serving to distinguish between the sexes at all ages, even in some fetal specimens. In *americana* the tail appears to be white, except for a tawny basal area on its upper side, but in *mexicana* the sides of the tail are grayish drab.

Variations in color.—Considerable color differences are dependent upon season, sex, and age. An adult male (No. 440, Mearns's collection), killed in the Mogollon Mountains, 25 miles northeast of Fort Verde, central Arizona, August 2, 1886, is in full summer pelage.

The face has a jet-black area, beginning at the nares, which it involves, passing backward to the horns, where it ends abruptly, extending laterally to the orbits. On the forehead, in the middle of this black area, are a few light hairs. Upon the sides of the head below the ears is another large black patch, which shades off to reddish fulvous and white. The cheeks, space between horns and around base of ears, and the lips are pure white or whitish. Below the white cheeks and black forehead are patches of pale fawn color. The ears, which resemble those of the horse, are very acutely pointed, straight-edged for basal two-thirds anteriorly, then sinuously curved—at first concave and then convex on border—to the tip, which points toward the horn, and regularly rounded on the posterior border; convexity of ear pale fulvous; its terminal portion edged with black; its extremity tipped with black, somewhat mixed with fulvous, on both surfaces; inner surface of ear white, except at one point, where the fulvous extends over upon the posterior border from the outside.

Adult male (No. 379, Mearns's collection), killed in the Mogollon

Mountains, central Arizona, April 3, 1886, and still in winter pelage, has the lower jaw and space between rami of mandible all white. A band of white 25 mm. in width borders the upper lips, extending to the naked muffle (which divides the lips by a narrow septum), except a dusky spot posteriorly. Another dusky spot—yellowish brown mixture with plumbeous—occupies an area at the angle of the mouth, extending backward about 25 mm. The white of the upper lips and lower jaw is confluent behind this angular spot, and extends backward upon the cheeks, decreasing to a terminal point below the middle of the eye. The inner surface of the ears—which are coated with long hairs—and base of ears anteriorly and externally are also white. There are two crescentic white patches upon the sides of the neck behind and below the ears, separated by a narrow mesial stripe. Behind them is another semilunar area of white which extends across the underside. The upper surface of the head, backward to between the horns, is dark brown, almost blackish anteriorly, grizzled posteriorly, and mixed with pale yellowish. There is also a blackish brown area at the anterior base of the horn, extending to the eye, and another below the ear, which latter is edged with the same except below. The rest of the head and neck is yellowish, or reddish brown of different shades, varying from buckskin, on the convexity of the ears, to chestnut rufous upon the mane, which begins upon the occiput and has a considerable admixture of dusky tips to the hairs.

Adult female (No. 381, Mearns's collection), from same locality as above, killed April 1, 1886, has the coloration of the underside of the head and neck the same as in the male above described, except that the white crescents upon the upper part of the neck are entirely united, forming a large white crescent or shield shaped mark. The coloring above is paler. The blackish brown color of the face extends backward little if any beyond the tips of the nasal bones; color thence to the line of the eyes yellowish. There is some admixture of black tips to the hairs between the orbits. There is no distinct black spot at the anterior base of the horn, but the lashes and a small spot above the front of the eye are black. The long hairs at the base of the horns are blackish, instead of being nearly white as in the male. Spots on upper lip and angle of mouth obsolete.

A yearling (?) female (No. 380, Mearns's collection), from the same locality as above, April 3, 1886, has the coloration still paler than that of the adult female. The dark areas are still more restricted, there being no trace of dark spots on upper lip and at angle of mouth. The pure white areas are more extended. The horns are nearly concealed by the hair, which forms a black spot around them.

In the above-described specimens the hairs of the yellowish areas are somewhat paler on the tips, light plumbeous at base, and wavy. The longest hairs of the mane, in the male, measure 120 mm. in length. They are broadly white at base, succeeded by reddish brown and a narrow annulus of yellowish white, pointed with black. In the white areas the hairs are white to the base.

A male fetus (No. $\frac{20566}{35849}$ U.S.N.M.) that would soon have been born, removed from its mother (No. 1889, Collection International Boundary Com.) June 15, 1892, is grayish buff, finely lined with black, slightly stained with russet on the head and rump, which latter is white only in two lateral spots. A large white spot occupies the forehead. There is some black on the edges of the ear, the end of the muzzle is black, and there is a small black spot above each eye. The hoofs are black, tipped with horn color, with reddish hair growing around the base. Underparts buffy, liberally sprinkled with white hairs in the middle. The white areas on the underside of the neck and the triangular black sex mark on the sides of the head are plainly indicated.

An albino antelope was seen by many persons between the Verde Valley and Whipple Barracks, Arizona, in 1885, and was not known to have been killed up to the time of my departure in 1888.

Young a few weeks after birth are paler than adults, without the distinct rump patch of white, this part being overlaid with pale russet; and all of the pattern is obscure, the white areas being stained with dull buff, and the areas which are blackish in adults but faintly indicated. A curl of dusky hair over the frontal bone, on each side, indicates the location of the coming horns of the male.

Molting period.—We killed the first Mexican antelopes on the boundary in the desert region between the Rio Grande and Mimbres valleys, late in March, 1892. At that season they were beginning to shed about the face. A male killed between the Mimbres Valley and the Upper Corner (Monument No. 40), April 29, had received the summer coating on about one-half of the head. By the end of May, all of the old males had shed the winter hair from all of the head, and, in some cases, from large areas of the body. An old male, killed in the Animas Valley, New Mexico, July 6, was in full summer coat; but not all of the antelopes had changed by that date.

Cranial characters.—The skull (fig. 33) differs from that of *americana* in having the orbits less abruptly protruding antero-inferiorly, and the premaxillaries more slender posteriorly; audital bullæ thinner; lips of posterior nares longer.

Horns.—In females the horns are sometimes absent or abortive, occasionally quite large; but the horns of adult males are invariably much larger than those of females. These appendages are essentially processes of the frontal bone of the skull, which consist of simple flattened blades (fig. 33) of the bone, called horn cores, covered by a horny sheath having a decurved tip and flattened lateral prong. The prong-horn antelope differs from the true antelopes in the deciduous character of the horny sheaths of the horn cores, which are frequently, perhaps annually, shed. The horny sheath is a result of a special development of the outer skin or epidermal tissue covering the horn cores. In males the end of the horn is whitish horn color, all of the remainder glossy black; but in the female the horns are all black. An adult male (No. 440, Mearns's collection), killed August 2, 1886, in the Mogollon Mountains of central Arizona, had horns which were loosened and nearly ready to be shed. With some difficulty I managed to pull them off, and found new horn sheaths growing beneath. They were still in the condition of vascular, hirsute membranes of considerable thickness, resembling ordinary integument, and coated rather sparsely with long hairs. At the apex was a soft, fleshy, nipple-like process, loose and without hair, which first becomes converted into horn, forming the whitish tips. The apices of these bony tips were 260 mm. apart, and each measured 175 mm. in length, from the hair of the forehead. The horns themselves measured as follows: Total length, following the curves, 380 mm.; length, in a straight line from recurved tip to base, 245; from base to superior base of the prong, 148; length of prong, 60; width of prong at base, 55; circumference of horn near base, 150; circumference of horn above prong, 104. The horns are much compressed laterally from the base to the prong, which latter is remarkably flattened; above the prong the horn becomes subcylindrical. In this individual the horns would probably have been cast before the middle of September. An adult male (No. 276, Mearns's collection), killed near the same locality, in the pine forest of the Mogollon Mountains, November 4, 1885, had recently cast the horn sheaths; those replacing them were thickly coated

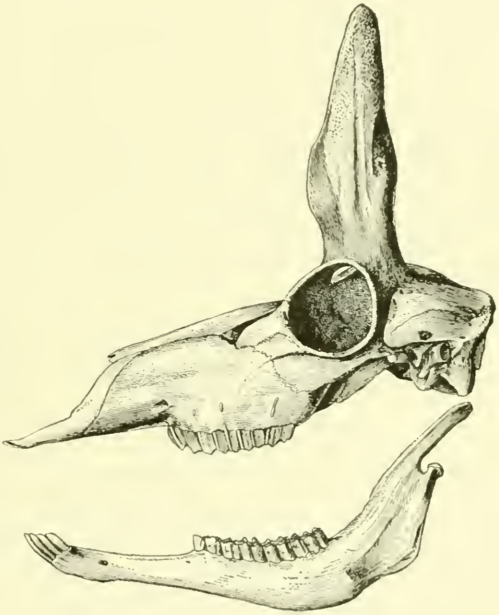

FIG. 33.—SKULL OF ANTILOCAPRA AMERICANA MEXICANA.

with "velvet" and still perfectly soft, except the horny, loose tips. Several horn sheaths, apparently not very old, were found by members of the survey, west of the Rio Grande, during March, April, and May, 1892; but all of the adult antelope killed, that I examined, had perfect horns. Females lacking horns were extremely rare.

Weight.—Adult male No. 63175, U.S.N.M., killed June 3, 1892, at the Playas Valley, near Monument No. 62, weighed 112 pounds, as killed, after bleeding; adult female (No. 1889, author's collection), killed June 15, 1892, in the same locality, contained two fetuses, and weighed 109 pounds as killed, after bleeding. Three adult males (Nos. $\frac{20352}{37088}$, $\frac{20351}{37089}$, and 63176, U.S.N.M.), weighed 64, 56, and 67 pounds, respectively, without viscera, head, feet, and skin.

Habits and local distribution.—The prong horn antelope is already a rare animal in the region of the Southwest, where it ranged in thousands twenty-five years ago. In much of the region covered by my field notes of the eighties no antelope can be found at the present day. The antelope was not uncommon from the Rio Grande to the Animas Valley during the operations of the International Boundary Commission, and antelope and deer were largely depended upon for a supply of fresh meat. A trooper of the Second Cavalry named Swartz, who was an excellent hunter, turned in more than 80 antelopes to the general mess from May to July, 1892. I have recently been informed that it would now be difficult to see that number in the whole region. In view of the present scarcity of this beautiful ungulate, I will give in detail such notes as are contained in my notebooks of years ago, beginning in 1884, when great herds of them could be seen in crossing the Territories of New Mexico and Arizona by rail. Herds were frequent between Ash Fork and Whipple, along the stage route in March, 1884. At that time thousands of them were killed annually around the San Francisco and Bill Williams mountains, but none remained in the immediate vicinity of Fort Verde, my first army station. About that time hunters began to comment upon its rapidly decreasing numbers throughout the region, and by the year 1888, it had become comparatively uncommon except in restricted areas still unoccupied by the whites.

On the northern plains the vast majority of antelope were supposed to pass their entire lives in the open country away from forests, but in Arizona and New Mexico the mountains were occupied during the summer and the lower mesas and valleys in winter. In 1887, I found newly born young during the first half of June on two sides of the San Francisco Mountain, close to the upper limit of *Pinus ponderosa*, above 2,424 meters (8,000 feet). It was also breeding through the pine zone of the Mogollon mesa and Great San Francisco forest. West of the Verde River I also found young fawns in open, hilly country in 1887 and 1888. The season of birth is more protracted than at the north. Three females killed on the Mogollon mesa March 10, March 11, and April 1, 1886, contained 2 fetuses each, the last noted as large. A female (No. 1889, Mearns' collection), killed June 15, 1892, at Whitewater, near Monument No. 61, contained two fetuses—male and female—ready for birth; another in the same region contained a single small fetus June 1, 1892, and on September 23, 1893, I saw a female with small twin fawns close to the lower timber line and Monument No. 64, at the east base of the San Luis Mountains. Many antelope with (usually) twin fawns were seen around San Francisco Mountain, and also on the Mexican Border, during the month of June, which is probably the month during which most antelopes are born in those latitudes.

Unborn fetuses of antelope and deer are regarded as table delicacies by the Indians of the Southwest. The young are hidden by the mother at birth, and often fall a prey to wolves and coyotes when she is absent feeding. When the fawns are following their mother, and the latter is shot, the young will follow the hunter, and immediately become tame, making pets. In 1884, Capt. Gerald Russell kept a pet antelope at Fort Verde. I found that it was acutely sensitive to sounds. When walking it liked to follow persons, especially women and children; but it was easily startled by the fall of a small pebble, and would flee from the sound in terror, immediately returning. It was often pursued by dogs of the post, but could easily outrun any of them, seeking shelter with the soldiers in the barracks when weary of running from the dogs. It entered houses during the heat of the day, and I sometimes found it sleeping on my bed.

When the country was first settled by the whites, Dr. Elliott Coues found an abundance of antelope around old Fort Whipple, Arizona, where he obtained specimens. I saw a small herd about the Point of Rocks, on Granite Creek, near Whipple, November 6 to 13, 1887. On November 14, 1884, signs of them were seen from Cataract Creek to Pine Springs, along the canyon of the Colorado River, in northern Arizona; and the species was seen in considerable numbers about the latter place later. Two were seen on a bluff near Peach Springs, Arizona, November 19, 1884. A band of several hundred was seen between Aubrey Station and Prescott, Arizona, November 21, 1884. On the following day several herds were found in Big Chino Valley, between Sullivan's ranch and Garland and Ross's ranch. One herd, startled by the pack train at the rear, crossed the trail in front of me, passing through a herd of range cattle almost as wild. After reaching the summit of a ridge the antelope stopped, faced about, and took a good look at us before passing out of sight. On November 23, 1884, we noted them in abundance between Garland and Ross's ranch and the American Ranch, at the foot of Granite Mountain, near Prescott. In the red-juniper zone, between Ash Fork and Stones Lake, November 7, 1884, antelope were seen bounding through the groves of "cedars" and grassy plains between, over which the trail passed. They appeared very white, and were very conspicuous, as antelope always are, unless they are lying down. Their tracks were very numerous in the mud around Stones Lake, a sheet of water covering about 20 acres. In the spring of 1888 I saw a number of scattered individuals on the west slope of the Verde Mountains, in Agua Fria Basin. I never saw an antelope in the low valley of the Verde River; but its use as food, in ancient times, by the cliff dwellers is attested by an abundance of charred bones found in many of their cliff houses and cavate dwellings.

Antelope still existed in the Red Rock Country of Oak Creek, one of the headwaters of the Verde River, during the eighties. From my notebook I extract the following:

January 14, 1885.—We left Fort Verde at sunrise and traveled to Thompson's Ranch, on Oak Creek, Arizona, a distance of 25 miles. For the first five or six miles the trail lay across a sandy, mesquite-covered plain, and low hills bare of trees between Beaver Creek and the Rio Verde. We then crossed a succession of cedar-clad ridges in which deer are often seen, and thence descended to a wide, grassy prairie, bordered by foothills with cedars upon their slopes. There we found plenty of tracks, but saw no antelope, until, on cautiously peering over the first ridge after leaving the prairie, I saw a herd of them feeding among scrub oaks about 200 yards distant. I had ridden ahead with only a shotgun, and, the country being open, did not attempt stalking them, but waited for the buckboard to come up with the rifles. I motioned to the driver to stop, and immediately three rifles were brought up to the top of the hill, but not before the wary creatures had sniffed the breeze and betaken themselves to their hoofs. Smith could not be restrained from letting fly at them at 300 yards as they trooped off in single file; otherwise we might have successfully stalked them, as the country was hilly and afforded cover. I gave Fox my horse and took a seat in the buckboard, directing him to take his own time and look for the antelope beyond a high ridge over which they had disappeared after winding in zigzags to avoid some buttes and canyons, often pausing to look at our party from some eminence. There were 14 in the band, and they were the only antelope seen on the trip. Fox rejoined us at Beaver Head, having failed to shoot an antelope. He had found the herd twice, but each time the herd discovered him first and betook themselves to flight, disappearing immediately from view behind the hills upon which they had been watching. Antelope are common, in suitable places, throughout this general region.

August 12–14, 1885.—Visited Oak Creek. Going out we saw no antelope, but, returning on the 14th, ten were seen near the Bell Mountain, not far from Oak Creek, in the Red Rock Country.

In 1886 and 1887, when I crossed the Great San Francisco Forest, visiting Flagstaff and the San Francisco Mountain, antelope were frequently noted, ranging upward through the whole of the pine zone. In June the mule deer was most frequently seen on the ridges in the pine forest; but the antelope came down into grassy openings called "parks," or else lived in the most open pine woods. One buck was so gentle, or possessed so much curiosity, that I killed it with my shotgun. Another was shot near Flagstaff as late in the year as November 4, 1885. Five antelope were passed by near the headquarters of the Arizona Cattle Company, near Flagstaff, Arizona, June 3, 1887. We afterwards found them abundant on the timbered ravines and slopes of San Francisco Mountain, where again some were killed with the shotgun. Enormous herds were seen in open parks near the base of the San Francisco cone. The highest were seen at the altitude of 2,500 meters (8,250 feet), above Little Spring, at the north base.

East of the Verde Valley antelope were first noted as seen between Clear Creek and Saw Log, October 2, 1884. At Mud Tanks, a few miles farther up the Mogollon Mountains, they were always to be found from 1884 to 1888. I saw them at many places on the Mogollon Mesa during those years; but the herds were smaller than those around the base of San Francisco Mountain.

In his Snake Dance of the Moquis, Capt. John G. Bourke gives the following:

> We passed [near the Hopi villages in northeast Arizona] close to an antelope "corral" of the Navajoes. These are made of two converging lines of stone and brush. The Navajo warriors, mounting their fleetest ponies, will scour the country for miles, driving before them the luckless game, which after a while reaches the narrowest point of the corral and then falls a victim to the hunters in ambush. The Indians are careful not to kill all, but to allow a few to escape. This forbearance is partly based upon a desire to allow the game to reproduce, and is partly religious in character.

Many of these antelope fences were seen in eastern Arizona.

The antelope has given rise to several place names in the Southwest, among them Antelope Tanks, in the Great San Francisco Forest, and Antelope, on Ash Creek, only a few miles from Bumble Bee, Yavapai County, Arizona, where we killed an antelope March 26, 1885, on a march across southern Arizona and New Mexico to Texas and returning. On this expedition antelope were noted as follows: Between Red Rock and Rillito, Arizona, an adult female antelope was brought in by a soldier. Some were seen between Lordsburg and Separ, New Mexico, April 16, 1885. From Separ to Gage, New Mexico, antelope signs were everywhere abundant; and from their numerous tracks they must have been present in large bands. On May 2, 1885, in the foothills near Dragoon Summit, on the Southern Pacific Railroad, the troopers of the Tenth Cavalry fired upon a herd of antelope; and as late as November 3, 1892, I saw five antelope from the railroad at Bowie Station, southeastern Arizona.

From the Mexican border I have a few records. I never saw antelope in Texas, but transcribe a letter from Dr. Paul Clendennin, who rode with the Third U. S. Cavalry from Fort Verde, Arizona, to Fort Davis, Texas, accompanied by the author as far as Deming, New Mexico:

> FORT DAVIS, TEXAS, *May 27, 1885.*
>
> Coming down from El Paso I did not see many birds, but I rode off over the foothills and looked for antelope. We saw from 1 to 30 each day, but they were very shy and we could not get within 300 yards of any.

Doctor Clendennin also found antelope on Targot Creek, 30 miles from Fort Davis, Texas, in August, 1885; and they are well known to have been abundant in former times in western Texas. Along the Boundary Line it was seen at every camp between the Rio Grande and the Animas Valley west of the San Luis Mountains (Monuments Nos. 1 to 68.) In the vicinity of Dog Spring (Monument No. 55), New Mexico, 30 were shot for food between May 21 and June 13, 1892.[a]

Large herds watered at Lake Palomas, San Francisco Water, and the Corralitos River in Chihuahua, Mexico. On our return to this region in 1893, antelope were abundant on the West Playas; some were seen on East Playas; and at Dog Spring, September 15 to 23 one herd of 30 and several small "bunches" of them were noted. About 20 were seen on a trip from Lang's Ranch to Cajon Bonito Creek, September 8, 1893. A few were seen in the San Bernardino Valley near Monument No. 77 in 1892 and 1893. On the San Luis Mountains they were found up to 1,650 meters (5,412 feet). Some were seen in the San Pedro Valley, Arizona, north of Monument No. 92 in 1892; and a mounted specimen from near Tombstone, Arizona, was seen in the collection of R. F. Hafford.

When we were encamped at La Osa, Pima County, Arizona, antelope were found on the plains on either side of the Pozo Verde Mountains. One herd of 12 antelope visited the camp of the party engaged in building Monument No. 143, on the Moreno Flat. They were plentiful on the plains around Pozo de Luis, Sonora, Mexico, in December, 1893, and January following. Small herds were seen in January, 1894, on the Great Plain between the Cobota and Nariz mountains, and in the Santa Rosa Valley near Monument No. 161. They were abundant February 8, 1894, in the vicinity of Monuments Nos. 178 and 179. On February 9, 1894, when I rode across the Tule Desert from the dam at Monument No. 179 to Tule Wells, antelope were ranging in abundance if one could judge by the number of tracks seen, although I saw only 4 antelope at Monument No. 183. Lieut. D. D. Gaillard shot one near here on his first reconnoissance of this desert region. During February we saw more of them in the vicinity of Tule Wells and on the Lechuguilla Desert, between the Tule and Gila mountains. Dr. W J McGee writes that the fauna of Seriland, Sonora, Mexico, includes the antelope. Though not abundant, some antelope remained on the Colorado Desert. We saw their tracks near Gardner's and Laguna stations, and I have seen a specimen taken by Mr. A. W. Anthony west of the Coast Range in Lower California.

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[a] Lieut. D. D. Gaillard informs me that he kept an accurate account of the game obtained between El Paso and the San Bernardino River (Monuments Nos. 1 to 77), and that it amounted to 244 antelope and deer killed from March 15 to September 10, 1892.

Measurements of 10 specimens of Antilocapra americana mexicana.

Museum number.									From tip of nose to—				Fore limb.		Hind limb.		Horns.		
Skin.	Skull.	Original number.	Sex and age.	Locality	Date	Total length.	Head and body (from nose to tuberosity of ischium.)	Tail to end of vertebræ.	Ear.	Occiput.	Ear above crown.	Girth of chest.	From olecranon process of ulna to end of hoof.	From radiocarpal joint to end of hoof.	From kneejoint to end of hoof.	From hockjoint to end of hoof.	Height in straight line.	Greatest expanse of both horns.	Distance between tips.
						mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
2177	......	276	♂ ad.	Near Flagstaff, Arizona	1885. Nov. 4	......	......	......	250	295	195	......	......	......	......	......	175	......	......
2178	1980	379	♂ ad.	Eastern slope of Mogollon Mountains, Central Arizona.	1886. Apr. 3	......	......	......	265	345	203	......	......	......	......	......	220	280	72
......	1974	380	♀ juv.	.....do	....do	......	......	......	235	285	180	......	......	......	......	......	12	......	80
......	1977	381	♀ ad.	.....do	Apr. 1	......	......	......	255	320	195	......	......	......	......	......	85	135	126
......	......	589	juv.	Eastern base of San Francisco Mountain, Arizona.	1887. June 13	1,420	1,390	130	243	310	178	900	605	360	660	430	90	......	......
20341	37087	1713	♂ ad.	Near Monument No. 40, Chihuahua, Mexico.	1892. Apr. 29	1,333	1,185	148	229	295	163	890	620	320	......	435	......	......	......
20352	37088	1778	♂ ad.	Near Dog Spring, Grant County, New Mexico.	May 25	1,400	......	160	275	330	183	890	600	342	690	370	......	......	......
......	63175	1840	♂ ad.	Playas Valley, near White Water, Chihuahua, Mexico.	June 3	1,360	......	125	270	310	177	925	633	360	635	......	......	......	......
......	63176	1841	♂ im.	.....do	....do	1,375	......	138	265	320	172	880	560	330	580	400	......	......	......
......	......	1889	♀ ad.	Whitewater, near Monument No. 61	June 15	1,350	......	145	245	295	180	890	582	325	630	405	......	......	......

Family BOVIDÆ.

CATTLE, SHEEP, ETC.

Frontal appendages, when present, in the form of nondeciduous horns. Molars frequently hypsodont. Canines absent in both sexes. The lateral toes may be completely absent, but more often they are represented by the hoofs alone, supported sometimes by a very rudimentary skeleton, consisting of mere irregular nodules of bone. Distal ends of the lateral metapodials never present. In the majority of genera the horn cores are present in both sexes, although much larger in the male. (*Flower and Lydekker.*)

Genus OVIS Linnæus (1758).

Ovis LINNÆUS, Syst. Nat., 10th ed., 1758, p. 70.

Description.—Horns curving backward and downward in a bold sweep, with the tips everted, generally with more or less prominent transverse ridges, and brownish in color. Suborbital gland and lachrymal fossa usually present, but generally small. Foot glands in all the feet. Chin not bearded; males without a strong odor. (*Flower and Lydekker.*)

Dentition.—I. $\frac{0-0}{3-3}$; C. $\frac{0-0}{1-1}$; P. $\frac{3-3}{3-3}$; M. $\frac{3-3}{3-3}=32$.

Forms of the bighorn or mountain sheep, the only wild sheep of the Mexican Boundary Region, occur in precipitous mountains, ranging from sea level, at the Gulf of California, to the summits of the highest mountains, its range extending through each of the faunas from the Arid Tropical to the Arctic-Alpine.

OVIS CANADENSIS MEXICANUS (Merriam).

MEXICAN BIGHORN OR MOUNTAIN SHEEP.

Ovis mexicanus MERRIAM, Proc. Biol. Soc. Washington, XIV, p. 30, Apr. 5, 1901 (original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXXI, No. 3, Aug. 27, 1903, p. 72 (Syst. Results Study N. Am. Mam. during the years 1901 and 1902).—BARBER, Proc. Biol. Soc. Washington, XV, Oct. 10, 1902, p. 191 (Guadalupe Mountains, New Mexico and Texas, in March, 1901).

[*Ovis*] *cervina mexicanus*, ELLIOT, Field Col. Mus., Zool. Ser., IV, Pt. 1, 1904, p. 86, pls. XXXIV, XXXV (skull). (Mam. Mid. Am.)

Pang'-wŭh of the Hopi Indians of northeastern Arizona.

Cimarron of the Mexicans.

Type-locality.—Lake Santa Maria, Chihuahua, Mexico.

Geographical range.—North-central Mexico, northward into the mountains of Texas, New Mexico, and Arizona, ranging from the Upper Austral to the Boreal zone.

Description.—Following is the original description: "*Type* from Lake Santa Maria, Chihuahua, No. 99342, male ad. U.S.N.M., Biological Survey Collection. Collected Sept. 16, 1899, by E. W. Nelson and E. A. Goldman. Orig. No. 13974.

"*Characters.*—Size large; color dark, much darker than *nelsoni*, but less dark than *canadensis;* horns large, massive, dark, not strongly outcurved; hoofs and molars larger than in *O. canadensis;* ears long and large, nearly double the size of those of *canadensis*, measuring from occiput, in dry skin, 110–116 mm.; tail long and slender, measuring about 130 mm.; color pattern similar to that of *canadensis.*

"*Color.*—Body color above and below drab-brown, darkest on throat, legs and tail; no trace of dorsal stripe; muzzle decidedly paler than rest of face; rump patch broader and more squarely truncate anteriorly than in *canadensis;* dark color on hind leg covering much more of inner side of thigh than in *canadensis*, but much less of lower leg, the white spreading broadly over the posterior and inner aspects and on the inner side ending abruptly just above the calcaneal joint; whitish of chin broader and less sharply defined.

"*Cranial characters.*—Skull, as a whole, large and massive. Compared with *canadensis*, orbits less prominent; frontals flatter (less 'dished' in forehead); basioccipital narrow, its sides nearly parallel, its muscular facets small and median sulcus broad; occiput (viewed from behind) much narrower; depth of face (above molars) less; premaxillæ longer, more slender, and reaching much farther back; jugal relatively small and less expanded anteriorly; lachrymal long, reaching well out toward premaxilla; paroccipital narrower and more slender; lips of posterior nares (behind hamulars) thin and somewhat everted [in *canadensis* thickened and much swollen]; angle of mandible obsolete; coronoid process lower and less expanded. Molar teeth larger. Horn cores longer, with longer curve and less flaring base.

"*Horns.*—Large and heavy (fig. 34), but longer and less massive than those of *canadensis;* upper (flat) side narrower; base less flaring; orbital corner shortly rounded off (not produced).

"*Measurements.*—Type specimens, male, adult: Total length, 1,530 mm.; tail vertebræ, 130; hind foot, 425; height at shoulder, 900. An adult female from type locality: Total length, 1,490; tail vertebræ, 130; hind foot, 405; height at shoulder, 880."

In 1886 I noted that an adult male specimen belonging to Mr. D. M. Riordan, of Flagstaff, Arizona, and killed somewhere in that region, was paler in color than those from Colorado and northward, taken at the same season, and had longer, more pointed ears. Farther south, along the Mexican Boundary Line, where we found evidences of its existence in suitable places from southwestern Texas to the mountains of the Coast Range bordering the Pacific Ocean, I was unable to examine any skins from the eastward of the Tule Mountains, in the Western Desert Tract, though the species was seen in the Elevated Central and Eastern Desert tracts. From the examination of one skin from San Francisco Mountain, Arizona, and a small series of horns collected in the Dog Mountains, Grant County, New Mexico, and on the Verde River, Arizona, and from the observation of living animals in these regions I am inclined to consider the Bighorn of the Elevated Central Tract to be intermediate in characters between the northern Rocky Mountain form[a] and that inhabiting the Western Desert Tract, the latter being the very distinct race *nelsoni*, described below. For the present, with the scanty material available for study, I prefer to consider the Bighorns of the north-

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[a] The synonymy of this form is as follows:

OVIS CANADENSIS Shaw.

ROCKY MOUNTAIN BIGHORN.

Mountain Ram of North America MITCHILL, New York Medical Repository, 1803, p. 237, fig.

Bélier de Montagne E. GEOFFROY DE ST.-HILAIRE, Annales du Musée d'Histoire Naturelle, II, 1803, pp. 360–363, pl. LX (Canada, lat. 50°; long. 115°).

Ovis canadensis SHAW, Naturalist's Miscellany, XV, pl. DCX, with text, about Dec., 1803. (A penciled memorandum on the title page of the copy in the Library of Congress indicates that plates DLXXXIX to DCXIII were published in 1803. Plate DLXXXIX (the first in the volume) is dated 1803. Plate DCXIV is dated 1804. The intermediate plates are not dated. Pages preceding and following the descriptive text, which is not paged, are watermarked 1803.)—BIDDULPH, Proc. Zool. Soc. Lond., 1885, pp. 678–684 (reverts to this earlier name than *Ovis montana*, establishing *Ovis canadensis* in its place).—MERRIAM, North American Fauna, No. 3, 1890, pp. 78, 79.

Ovis cervina DESMAREST, Nouveau Dictionnaire d'Histoire Naturelle, XXIV, 1804, p. 5 (based on the Bélier de Montagne of Geoffroy); nouv. ed., XXI, 1818, p. 553.—RAFINESQUE, Am. Month. Mag., I, Oct., 1817, p. 436.—ALSTON, Biologia Centrali-Americana, Mam. 1880, p. 111.—ALLEN, Bul. Am. Mus. Nat. Hist., VII, 1895, p. 258 (gives important synonymy and attempts to establish *Ovis cervina* on the basis of the 1804 edition of Desmarest's Nouveau Dictionnaire d'Histoire Naturelle, but fails to show that this work antedated the publication of Shaw's *Ovis canadensis*, the name in current use).

Ovis ammon MITCHILL, New York Medical Repository, X, 1807, p. 35.—ORD, in Guthrie's Geography (2d Am. ed.), II, 1815, pp. 292, 308.—HARLAN, F. Amer., 1825, p. 164 (description from Lewis and Clark's specimens).—GODMAN, Am. Nat. Hist., II, p. 328.

Ovis montana CUVIER, Règne Anim., I, 1817, p. 267 (a name long current, but preoccupied by Ord's *Ovis montana*, the name which he applied to eastern half of Arizona, together with those of Texas, New Mexico, and the adjacent parts of Mexico, under the name of *Ovis canadensis mexicanus.*

The general color of the Rocky Mountain Bighorn is grayish brown, or, as Professor Baird says, "perhaps ashy plumbeous brown would express the tint more nearly." A mixture of burnt umber and sepia mixed with more or less white will approximate to most of the dark shades of its coloring. The rump, belly, and posterior surface of the limbs are white. The head, and especially the ears, are paler, and the muzzle is whitish. The tail is colored like the back, and connected with it by a narrow line of the same color. The horns are yellowish brown. The feet, which are elastic cushions, are plumbeous black. The horn figured herewith (fig. 34) is that of an adult male, killed on a little hill beside the ranch house, at Dog Spring, Grant County, New Mexico, September 11, 1893, and agrees in size and shape with others from the Dog Mountains, in the same region, collected by our party in 1892. Two of the horns (Nos. 63161 and 36332, U.S.N.M.) measured, respectively, 390 and 360 mm. in circumference at base, and 900 and 800 in length, following the outer curve. Horns from the Verde Valley, in central Arizona, are also quite similar, as are those from San Francisco Mountain.[a]

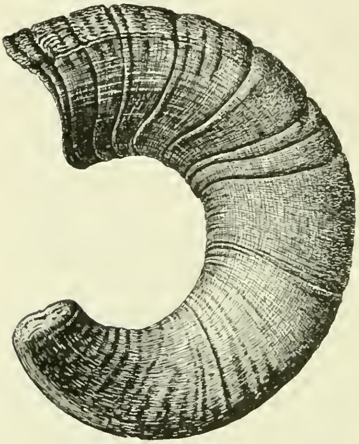

FIG. 34.—HORN OF OVIS CANADENSIS MEXICANA. (Cat. No. 36332, U.S.N.M.)

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the Rocky Mountain Goat, a wholly different animal, in 1815).—COUES and YARROW, Rep. Wheeler Survey, V, Zoology, 1875, pp. 68, 69.

Ægoceros (Ovis) montana, WAGNER, Suppl. Schreber's Saugthiere, IV, 1844, p. 505; V, p. 468.

Ovis pygargus HAMILTON SMITH, Griff. Cuvier, IV, 1827, p. 318, plate; V, 1827, p. 359.

Ovis californianus DOUGLASS, Zool. Journal, IV, 1829, p. 332.

Ovis californiana BLYTH, Proc. Zool. Soc. Lond., VIII, June, 1840, p. 65; Ann. Nat. Hist., VII, 1841, pp. 199, 260.

Ovis californica WAGNER, Schreber's Saugthiere, V, 1836, p. 1371.

Bighorn, LEWIS and CLARK.

Type-locality.—Canada, lat. 50°, long. 115°.=Rocky Mountains, in southern part of present Alberta, Canada.

[a] See Baird's Mam. North Amer., 1857, p. 677, figs. 30–32. "San Francisco Mountains, New Mexico."

Habits and local distribution.—Although still ranging through the Upper Austral, Transition, and Boreal zones of the mountains of the Elevated Central Tract, the mountain sheep has become a scarce animal. It is usually confined to rocky canyons and mountain peaks. On San Francisco Mountain, Arizona, its range reaches the Arctic-Alpine zone, above timber line. Lieut. A. W. Whipple's expedition obtained sheep at points along the thirty-fifth parallel, in New Mexico and Arizona.

In Arizona the bighorn has, until very recently, been quite generally distributed in suitable localities, from near sea level to the apex of the San Francisco peaks, the highest land in Arizona, having an altitude of upward of 13,000 feet. In June, 1887, I obtained horns of the mountain sheep at Smiths Big Spring, on San Francisco Mountain. (No. 599, Mearns' collection, now in the American Museum, New York.) At that time a goodly herd of them was ranging on the mountain. In the neighboring town of Flagstaff I examined a mounted male specimen in the possession of Mr. B. J. Brannan, whose brother had also obtained a specimen from San Francisco Mountain. (One of these was sent to the New Orleans Cotton Exposition.) Bighorns frequented the highest peaks of this mountain during the month of June, but in winter they doubtless descend to the lower levels; indeed, it was asserted by an experienced hunter that they abandon the mountain entirely during winter and resort to the neighboring canyon of the Colorado River, where the species is always abundant. Members of our party saw a number of them there in June, 1887; and in November, 1884, the writer saw the tracks of a large band of them that had recently passed through the midst of the village of the Havasupai Indians, in the canyon of Cataract Creek, close to its junction with the Colorado. The Havasupai manufacture dippers and ladles from the horns of the mountain sheep, some of which we collected for the Museum. On November 10, 1884, I camped at a spring in the left wall of Cataract Canyon, 27 miles above the Havasupai Indian village. The pack mules were suffering from thirst, not having obtained sufficient water at the previous camp, and here the water was found black, stinking, polluted by the carcass of a decaying mountain sheep, so that none of our animals would touch it. Years before, Major Price had made the only previous military expedition to this canyon. Dr. Elliott Coues, the medical officer, had wandered from the column in search of birds and had become lost. Indian scouts were sent out upon his trail. They, expecting to find him dead from thirst, planned a division of his clothing and equipments, and were sorely disappointed at finding him at one of these small "seep" springs, in the wall of Cataract Creek, serenely lunching upon roasted mountain sheep. We observed bones and several pairs of large horns at various places in Cataract Creek Canyon. Horns were seen at other places along the high bluffs of the Colorado Canyon, west of Cataract Creek, as far as Vitz's Crossing, 17 miles north of Pine Springs, where a handsomely carved fresh horn was seen in the possession of Hualapai Indians; and sheep were known to be common throughout the length of the Grand Canyon of the Colorado at that time. On March 8, 1886, Maj. E. K. Otey showed me the skull and horns of a bighorn, killed by Mr. Durfee at Bill Williams Mountain, Arizona. The Hopi Indians call the mountain sheep *Pang'-wŭh*. They said there were some remaining in the Hopi Country, but only a few, as they killed as many as possible for food. Mr. Stuart Daniels saw them three miles north of Mésa Butte, Arizona, at a season when they were in winter pelage.

In the Verde Basin, Arizona, from 1884 to 1888, the bighorn was occasionally seen. The female was commonly called the "ibex," and considered to be a different species from the male, on account of the very different shape of its horns. Several weathered horns were found near the (since abandoned) post of Fort Verde. It was not infrequently seen or shot in the surrounding mountains, and one was lassoed by cowboys, in 1888, about 15 miles southwest of Fort Verde. One was seen at Towel Spring, in the Box Canyon of the Verde River, in 1887. Several were shot from a flock of about 30 on Hardscrabble Mésa, southeast of Fort Verde, in 1884. About the same year Mr. Jack Davis, who resided on Rye Creek, killed a number of female sheep near the Natural Bridge, on Pine Creek, Arizona.

The opinion is general among the white settlers along the Mexican border that in that region the bighorn is doomed to extinction at an early period. For this reason it is considered worth while to enter into as detailed an account of its present or recent distribution as the meager observations contained in my notebooks will admit. I have been told of the killing of mountain sheep in the mountains of southwestern Texas by several persons, among them Lieut. Charles H. Grierson, who, in 1878, killed three adult males in a canyon of the Guadalupe Mountains, at an altitude of 8,000 to 9,000 feet, the highest elevation of the region being about 10,000 feet. Only these three were seen, in a pocket of a rocky canyon, whence there were but two outlets, one by which the hunter approached, and another which the distracted game passed by in their efforts to escape. When first seen all three leaped upon a high bowlder and gazed down at the hunter. One was shot, and the others in rapid succession when they stopped, out of curiosity, to look at the hunter. To judge by our own experiences, this tameness or stupidity is characteristic, and only the inaccessible nature of its retreats has enabled the remnant of the species to exist up to the present time.

In New Mexico, the bighorn is still found in numerous localities, and its Mexican appellation is perpetuated in the names of several places. It was found by our surveying party as far east as Monument No. 15, near which, on the northern border of the State of Chihuahua, two were seen by Señor Luis R. Servin, the accomplished photographer of the Mexican party, in June, 1892. He awakened from a siesta at midday to see the bighorns watching him intently from a hillside only a few yards distant. Edward Rector and Jack Doyle had killed many bighorns on the Hachita Grande Mountain, in Grant County, New Mexico, where I saw six in 1892 in a canyon at the east base. Numerous horns were seen in the neighboring Dog Mountains of New Mexico, and a large ram was killed within 500 yards of Dog Spring, Grant County, New Mexico, September 11, 1893, by Mexican employees of the cattle company of which Mr. Van Ormen was foreman. Mr. Van Ormen, who had occupied the ranch at Dog Spring for several years, had seen mountain sheep three times in the adjacent Dog Mountains. In 1890, he captured a young one that was accompanied by its mother and another female, both of which showed great pluck in defending the young one against the cowboys, who were obliged to "rock off" the old sheep before they could secure the prize. This young mountain sheep was only a few days' old. It drank cows' milk with avidity, but soon died. The season of its capture was "between spring and summer." On another occasion Mr. Van Ormen saw four sheep, and at another time eight, always in rugged canyons of the Dog Mountains. In the San Luis Mountains, where horns were found on the east slope in 1893 and signs of sheep were plentiful at the summit, its range extended from 1,700 to 2,498 meters. On August 15, 1893, I climbed a precipitous crag, known as the Niggerhead, south of Monument No. 82, and caught a glimpse of a mountain sheep. A short time previously one had been lassoed and killed by Mexican ranchmen near this mountain, which is on the Arizona section of the Boundary. At Tombstone, Arizona, in 1892, I saw the head of a bighorn in the collection of Col. R. F. Hafford, which was said to have been killed in the Glory Mountains, Arizona. Mr. Kempton, of Warsaw, Pima County, Arizona, informed me that a few mountain sheep had been known to exist in the Pajaritos Mountains during the years immediately preceding 1893. In the year 1885 I ascertained that mountain sheep occurred in the Santa Rita and Santa Catalina mountains, and that several were killed in those mountains during the winter of 1884–85 and the meat sold in the markets of Tucson, Arizona.

OVIS CANADENSIS GAILLARDI, new subspecies.

GAILLARD BIGHORN.

Type-specimen.—Immature female, skin and skull, No. 59906, U.S.Nat.Mus. Collected in the Gila Mountains, between Tinajas Altas and the Mexican Boundary Line, in Yuma County, Arizona, February 21, 1894, by Edgar A. Mearns. (Original number, 3029.)

Characters.—Size, small; color, peculiar; muzzle, dark colored; feet, very small; horns, long and strongly incurved; space between horns very wide, admitting 2 or 3 fingers.

Color.—The type (in winter pelage) has the upper parts ecru drab, becoming darker on the nape and front of limbs, and slightly darker on the shoulders, hips, and middle of back; but without a dark vertebral stripe. The rump, belly, and posterior surface of limbs are white. The tail is dark brown, this color running forward in a narrow interrupted stripe toward the back, dividing the white rump. The head and neck, except the dark brown mane, are nearly unicolor, like the back, except that the end of the lower jaw is grayish white. The ears are not much paler than the surrounding parts, except on the inside, which is grayish white. Just behind the white axillæ, for a handbreadth, the summer coat has been acquired, and is clay color. The limbs are dark brown (almost seal brown), externally and anteriorly, and in a broad band posteriorly connecting the accessory and lower hoofs; the remainder white. Iris yellowish hazel.

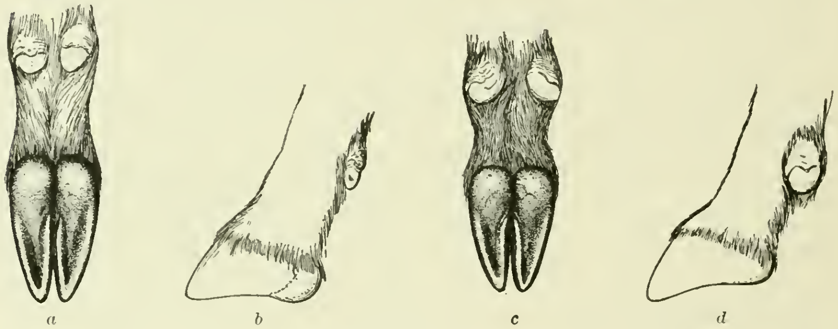

FIG. 35.—OVIS CANADENSIS GAILLARDI. FEET OF ADULT MALE. (Cat. No. 21392, U.S.N.M.) *a* AND *b*, FOREFOOT; *c* AND *d*, HINDFOOT.

An adult female specimen (No. 21392, U.S.N.M.), killed in the same place as the type in April, 1892, is in the short summer pelage. The color is pale, dusty buff, scarcely as dark as clay color, but deepening to drab on the neck. The dark line dividing the rump is scarcely perceptible, and there is no dark vertebral stripe.

The head of an old ram, in the private collection of Maj. D. D. Gaillard, who shot it in the Gila Mountains and presented its feet to the U. S. National Museum (fig. 35), shows the same difference in the color of the head as those above described, these being the only bighorns I have examined in which the end of the muzzle and the throat were not white.

Skull and teeth.—The type is under-grown. Its posterior molars were just coming up to their place, and there were but five lateral teeth in each jaw (fig. 36). These teeth are large and intermediate in measurements between comparable immature female topotype of *Ovis canadensis nelsoni* and *O. c. mexicanus*. The rostrum and nasals are shorter, and the size smaller than in *nelsoni* or *mexicanus*.

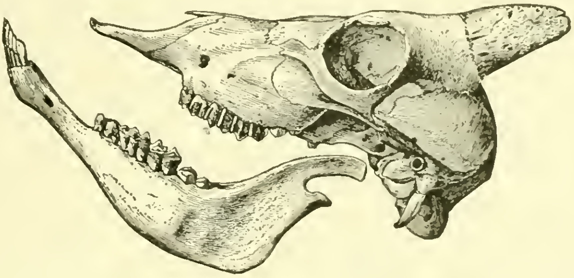

FIG. 36.—OVIS CANADENSIS GAILLARDI. SKULL OF TYPE. (Cat. No. 59906, U. S. N. M.)

The only adult skull (Cat. No. 59907, U.S.N.M.), a topotype, is imperfect from weathering. It differs from all others in the peculiar shape of the horns, which are strongly incurved (fig. 37), and in the great distance (50 mm.) between them. The horn of the type is shown in fig. 38. The molars are smaller than in *nelsoni* or *mexicanus*, but much larger than those of *canadensis;* the two posterior molars, taken together, measuring 45 mm. in length; the greatest breadth of the middle molar 16.3 mm.

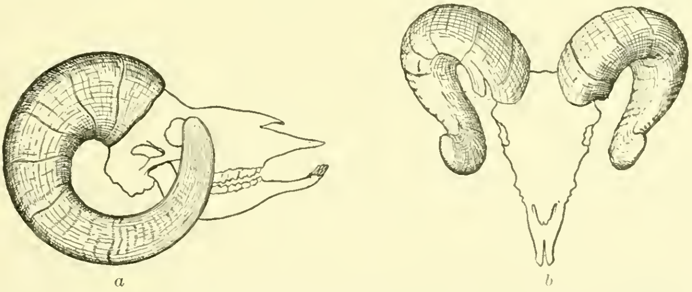

FIG. 37.—OVIS CANADENSIS GAILLARDI. SKULL OF ADULT MALE. (Cat. No. 59907, U.S.N.M.) *a*, LATERAL VIEW; *b*, DORSAL VIEW.

External measurements of type (immature female).—Total length, 1,200 mm.; tail vertebræ, 120; ear from crown, 120; ear from notch, 115; distance between eyes, 122; diameter of eye, 23; from tip of nose to eye, 167; to center of pupil, 184; to ear, 220; to tip of ear, 365; to angle of mouth, 60; fore foot with hoof, 270; hind foot with hoof, 315; height of animal at shoulder, 770; height at hip, 870; length of horn, 163.

Comparison with Ovis canadensis mexicanus and O. c. nelsoni.—I am indebted to Dr. C. Hart Merriam, chief of the Biological Survey of the U. S. Department of Agriculture, for the opportunity of comparing the Gaillard bighorn with the type series of *mexicanus* and *nelsoni*. *Ovis canadensis gaillardi* is smaller than either, and has relatively smaller feet. The type differs from Texan specimens of *mexicanus*—the only ones seen that were in corresponding winter pelage—in having the head practically unicolor without a white muzzle, and in the pattern of white and seal-brown markings on the limbs. The head of the adult male, and skin of adult female (No. 21392, U.S.N.M.), which are comparable with the ten specimens (type and topotypes) of *nelsoni* from the Grapevine Mountains, California, are more strongly colored than the latter; and the narrow vertebral stripe, usually seen in *nelsoni*, is obsolete. The color differences in these three forms of sheep are closely parallel to those of the coyotes of the same regions.

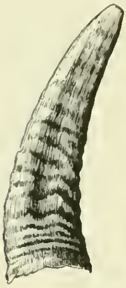

FIG. 38.—OVIS CANADENSIS GAILLARDI. HORN OF TYPE.

Comparison with typical Ovis canadensis.—I have failed to appreciate any important differences of color in the bighorn of Montana—which is doubtless the same as the form from the Rocky Mountains of southern Canada—and that of Colorado. A fine old male (No. 12679, U.S.N.M.) from Twin Lakes, Colorado, killed above timber line October 2, 1874, by Mr. C. W. Derry, is in the dark coat. The general coloration is dark brown, of a shade between burnt umber and sepia, darkest on the neck and limbs, the long hair on the back of the neck, which is the darkest part, being as dark as seal brown. The rump, abdomen, and posterior surface of the fore and hind legs are white. The tail is dark brown, this color running up on the rump, which it divides into two white areas. The ears and end of muzzle are dirty white. The coat is long and dense throughout. Length, 1,664 mm.; ear from crown (about) 100. "Iris, golden gray; center, rich brown." Other specimens from near the Canadian border of the United States, do not differ appreciably from the one just described. Compared with these, the type of *O. c. gaillardi* from the Gila mountains (No. 59906, U.S.N.M.), described above, a winter specimen, is very much paler throughout. Its pelage is very much shorter and its ears longer and more pointed. The ears of this immature female are actually longer than those of the largest males in the northern series, besides being more pointed apically and short haired. It also differs from them in having the white of the rump blended with the coloring of the flank, instead of being sharply defined. The muzzle is abruptly whitish in the northern animal and unicolor with the rest of the head in the southwestern desert form. Besides these differences, the median dark line which divides the white of the rump into two parts is obsolete and noncontinuous in the southern specimen, which also has more white on the inner side of the heel, opposite the tibio-tarsal articulation. The summer female of *O. c. gaillardi* (No. 21392, U.S.N.M.) from the Gila Mountains, Arizona, is much paler than one in corresponding pelage from Wyoming (No. 11891, U.S.N.M.) the former differing from the latter to about the same extent that the winter skins just compared differed from each other. The skull of an old male from the Gila Mountains, Mexican Boundary Line (No. 59907, U.S.N.M.), is broader across the forehead and has a stouter muzzle than an old male collected by the Northern Boundary Survey in Montana (No. 13962, U.S.N.M). The horns of the male of the Gaillard bighorn are curved in a closer spiral than those of the northern typical form (fig. 39), and in *Ovis stonei*,[a] *O. canadensis dalli*, and *O. nivicola* the tips of the horns become more and more divergent. Two pairs of horns of adult males were measured at Tinajas Altas, Yuma County, Arizona (Nos. 59907 and 59908, U.S.N.M.), which were 720 and 820 mm., respectively, in length, following the outer curves of the horns, and 365 and 360 mm. in circumference at base. The first horns of the young male are quite different in form to those of the female.

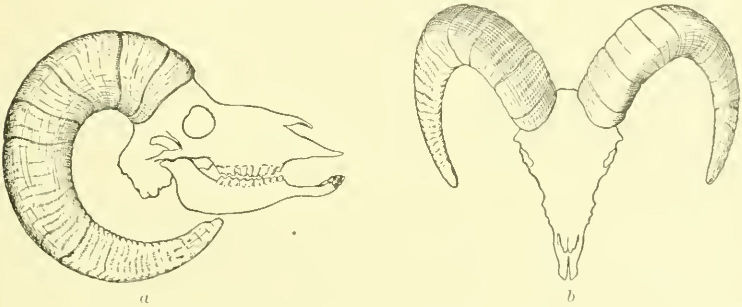

Fig. 39.—Ovis canadensis. Skull of adult male. Three Buttes, Montana. (Cat. No. 13962, U.S.N.M.). *a*, Lateral view; *b*, dorsal view.

Geographical range.—Low desert ranges in the Austral Life Zone, south of the Gila and east of the Colorado River, ranging south into Sonora, Mexico, as far as Seriland, opposite Tiburon Island, in the Gulf of California.

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[a] *Ovis stonei* Allen, Bull. Am. Mus. Nat. Hist., IX, Art. VII, April 18, 1897, pp. 111–114, pls. II, III. Type from the headwaters of the Stikine River, British Northwest Territory, near the Alaskan boundary, at an altitude of about 6,500 feet.

Habits and local distribution.—On March 30, 1885, I saw horns of mountain sheep nailed above the doors of a corral at Maricopa, Arizona, which were shaped like those of the present form. The sheep were doubtless killed on the road between Yuma and Maricopa. In 1884, an old man named Pease, who drove General Crook's army wagon, related experiences in hunting sheep in earlier years, when they were abundant and tame, on the stage route along the lower Gila, where he was employed as a driver.

During the survey many sheep horns were seen in the region between the Pajaritos Mountains and the Colorado River. A hunter and prospector, named Williams, who accompanied us, saw sheep and fired at one in the Cobota Mountains, near Pozo de Luis. Horns were seen in the Papago Indian settlement at Nariz Mountain. The Papagoes said that sheep were quite numerous in higher ranges visible from Nariz. These Indians slay many, and sheep are consequently growing scarce. Horns were seen at Sonoyta and in the Papago settlement below Sonoyta. Many horns were seen in the hills surrounding Quitobaquita, Pima County, Arizona, in 1894. A bighorn had been lassoed by ranchmen at the pool at Quitobaquita shortly before our arrival. The surveyors saw sheep in the rugged Tule Mountains in 1892. When my party was there, in February, 1894, no sheep were seen, but many tracks and heaps of horns were noted, as also in the neighboring Granite Mountains. During our stay at Tinajas Atlas, at the foot of the Gila Mountains, from February 14 to 23, 1894, sheep were seen on four occasions, in flocks of 6, 3, 3, and perhaps as many as 20. They were feeding largely upon a *Cylindropuntia* cactus, in valleys at the base of the mountain, but tracks and beds were seen at all altitudes. Dr. W J McGee writes that "the fauna of Seriland includes the bighorn."[a]

Record of 7 specimens of Ovis canadensis gaillardi.

Museum number.		Original number.	Sex and age.	Date.	Locality.	Remarks.
Skin.	Skull or horn.					
21392	....	2487	♀ ad.	Apr., 1892....	Gila Mountains, near Monument No. 190.	Flat skin and feet sent in by Maj. D. D. Gaillard.
59906	59906	3029	♀ im.	Feb. 21, 1894..	.....do.....................	Skin and skull of type.
	59907	3030	♂ ad.	Feb. 22, 1904..	.....do.....................	Imperfect weathered skull.
	59908	3031	♂ ad.	.....do	.....do.....................	One weathered horn.
	63162	3105	♀	Feb. 11, 1904..	Tule Wells, near Monument No. 186.	Do.
	63163	3854	♀ juv.	Apr., 1902	Tinajas Altas, Gila Mountains, Yuma County, Arizona.	One horn of young individual, killed by Mr. Joe H. Wheeler.
	(?)	......	♂ ad.	1892..........	Gila Mountains, near Monument No. 190.	Feet. Head in the possession of Maj. D. D. Gaillard.

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[a] National Geographic Magazine, X, April, 1896, p. 130.

OVIS CANADENSIS NELSONI (Merriam).

NELSON BIGHORN.

Ovis nelsoni MERRIAM, Proc. Biol. Soc. Wash., XI, pp. 217, 218, July 15, 1897 (original description).—MILLER and REHN, Proc Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 23 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Ovis cervina*] *nelsoni*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 46 (Synop. Mam. N. Am.).

Type-locality.—Grapevine Mountains, on boundary between California and Nevada, just south of latitude 37°. (Type, skin and skull, No. $\frac{28383}{40487}$, U.S.N.M.)

Geographical range.—Desert ranges of mountains of southern California and northern Lower California, in the Western Desert Tract. The habitat of this race extends from the Arid Tropical fauna at sea level up to the Transition Zone on the mountains.

Doctor Merriam's original description of this form reads as follows:

> Mountain sheep were found by the Death Valley Expedition in several of the desert ranges of southern California and southern Nevada, where ten specimens were secured by Mr. E. W. Nelson. They were killed in the northern continuation of the Funeral Mountains, locally known as the "Grapevine Range." Compared with the well-known Bighorn of the Rocky Mountains and Cascade-Sierra system, they are much paler in color, somewhat smaller in size, and have very much smaller molar teeth. Compared with *Ovis stonei*, recently described by Doctor Allen, the contrast in color is even more marked, but the pattern seems to be the same, and the darkening of the underparts and legs is also a character of *stonei*. In the absence of necessary material for comparison it seems best to treat the new form as a full species.
>
> The geographic range of the southern Bighorn is unknown, but it is probable that all of the sheep of the semibarren desert ranges of Mexico and the southern United States from Texas to California belong to the present form.
>
> It is a noteworthy coincidence that Mr. Nelson, who in northern Alaska discovered and named the northernmost American Sheep (*Ovis dalli*), should also secure, in the Sonoran deserts of California, the southernmost representative of the group. In view of these facts it seems peculiarly appropriate that the new sheep should perpetuate Mr. Nelson's name, which I take pleasure in bestowing upon it.
>
> #### OVIS NELSONI sp. nov.
>
> *Type* from Grapevine Mountains, on boundary between California and Nevada, just south of latitude 37°. No. $\frac{28383}{40487}$, female adult, U. S. Nat. Mus., Biological Survey Coll. Collected June 4, 1891, by E. W. Nelson. Original No. 942.
>
> *General characters.*—Apparently similar to *Ovis stonei* Allen in pattern of coloration, but much paler: rump patch small and completely divided on median line; tail short and slender; molar teeth very small.
>
> *Color.*—Upper parts, except rump patch, pale dingy brown; underparts and legs much darker, contrasting sharply with the white areas; inguinal region, hinder part of belly (narrowing to a point anteriorly some distance behind fore legs), inner aspect of thighs and posterior aspect of fore and hind legs, white.

Measurements (taken in flesh by collector).—Total length, 1,280; tail vertebræ, 100; hind foot, 360; height at shoulder, 830. In the dry skin the rump patch measures about 190 in breadth by 150 in length (from apparent base of tail.) (Proc. Biol. Soc. Wash., XI, pp. 217, 218.)

Remarks.—This was probably the first-known form of our bighorns. In the first American edition of Bewick's History of Quadrupeds, published in New York in 1804, we find the following under the heading of "The wild sheep of California" and a figure of a male bighorn:

> These creatures were observed by the Jesuit missionaries to California as long ago as the year 1697. They are of several varieties and colors and are reckoned excellent and dainty food. There is a figure of one in Venegas's History of California, which, being incorrect, we have thought it worth the while to give a new one delineated from nature (the specimen "brought to New York in 1802 by Mr. M. McGillivray, who killed it in latitude 50° north").

In an important article On the geographical races of the Rocky Mountain bighorn, by Lieut. Col. John Biddulph, F. Z. S., published in the Proceedings of the Zoological Society of London, 1885, the author writes that—

> the earliest notice is to be found in the account of California by Father Picolo, one of the first Catholic missionaries who visited that country in 1697." (Abridg. Phil. Trans., London, V, p. 459.) He describes it as a sort of deer. It is as large as a calf of 1 or 2 years old; its head is much like that of a stag; its horns, which are very large, like those of a ram; its tail and hair are speckled and shorter than a stag's, but its hoof is large, round, and cleft as an ox's. Their flesh is very tender and delicious. It is also mentioned by other Spanish writers in California of that period. The species then appear to have been lost sight of by naturalists of the eighteenth century.

Sheep are known to live on the isolated mountains of the Colorado Desert, in Lower California. Sometimes they are killed on the desert plain; but at such times they are probably passing from one range to another. A few horns and bones of sheep were seen in crossing the Colorado Desert; one horn of a young male at Gardners Laguna, Salton River, Lower California (No. 60863, U.S.N.M.). As soon as the Coast Range was reached we saw many horns and a few fresh tracks about the rugged peaks. My Cocopa Indian hunter, Miguel, told me that he had slain many sheep on mountains which he pointed out from my camp opposite the mouth of Hardy River, near the mouth of the Colorado River. These mountains were a little south of west from that point. Miguel and others informed me that sheep were then abundant in most of the rocky ranges of northern Lower California. A ranchman whom I met in the Coast Range Mountains told me that some of his cowboys had roped (lassoed) and captured a mountain sheep on the Colorado Desert near Mesquite Lake. I find a memorandum of August 7, 1886, from an acquaintance, informing me that two Indian boys in the employ of

Capt. C. L. Jenks, of San Bernardino, California, would be able to get sheep for my collection from that region "at any time."

Order GLIRES.

RODENTS.

Mammals with the incisor teeth $\frac{4}{2}$ or $\frac{2}{2}$ in number, chisel shaped, adapted for gnawing; no canine teeth, a toothless space in the place of canines; molar teeth adapted for grinding; cerebrum small, little convoluted; intestinal canal elongate; ears and eyes usually well developed. Food chiefly vegetable. (*Jordan.*)

Suborder SIMPLICIDENTATA.

Only one pair of upper incisors, having their enamel confined to their front surfaces. Incisive foramina moderate and distinct; fibula not articulating with the calcaneum. Testes abdominal, and descending periodically only into a temporary sessile scrotum. (*Flower and Lydekker.*)

Family SCIURIDÆ.

SQUIRRELS AND MARMOTS.

Arboreal or terrestrial forms, with cylindrical hairy tails, without scales, and with twelve or thirteen pairs of ribs. Skull with distinct postorbital processes; infraorbital opening small; palate broad; $p\,\frac{2}{1}$ or $\frac{1}{1}$; first upper premolar very small or deciduous; molars rooted, tubercular. (*Flower and Lydekker.*)

KEY TO THE SCIURIDÆ OF THE MEXICAN BOUNDARY LINE.[a]

a. Without cheek pouches.................................*Sciurus* (p. 248).
aa. With internal cheek pouches.
  b. Nail of pollex rudimentary.
    c. Back grizzled, mottled, or narrowly striped..............*Citellus* (p. 326).
    cc. Back broadly striped.
      d. Head and neck with a mantle of rich golden color.
        Callospermophilus (p. 309).
      dd. Head and neck plainly colored like the back.
        Ammospermophilus (p. 297).
  bb. Nail of pollex well developed.
    c. Upper surface plain; body heavy and thickset; ears rudimentary; cheek pouches small..............*Cynomys* (p. 339).
    cc. Upper surface longitudinally striped; size small; form slender; ears long and pointed; cheek-pouches large; premolars $\frac{2}{1}$.
      Eutamias (p. 283).

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[a] The genus *Sciuropterus*, which taxinomically stands as the highest of the Sciuridæ, appears not to be represented along the Mexican line, though I have heard rumors of the existence of flying-squirrels in the Mogollon Mountains of central Arizona and in the Laguna and Cuyamaca Mountains of the Coast Range in California. I see no reason why there should not be some of them along the Rio Grande of Texas. Flying-squirrels are of common occurrence in Florida and Louisiana. Mr. Samuel N. Rhoads has recently described *Sciuropterus alpinus californicus* from the San Bernardino Mountains.

Genus SCIURUS Linnæus (1758).

Sciurus LINNÆUS, Syst. Nat., 10th ed., 1758, p. 64.

Tail long and bushy; ears well developed, sometimes tufted. Feet adapted for climbing, the anterior having 4 digits and a rudimentary pollex and the posterior 5 digits, all of which have long, curved, and sharp claws. Skull lightly built, with long postorbital processes; penultimate upper premolar, when present, minute. Mammæ, in the species on the Mexican border, 4 pairs. Diurnal and arboreal.

KEY TO SCIURUS FOUND ON THE MEXICAN BOUNDARY LINE, BASED ON EXTERNAL CHARACTERS.

a. Total length about 400 mm.
b. Pelage mostly rufescent above.
c. Median area of upper and under side of tail narrow and obscure, with the color of this part reddish above and gray below. *Sciurus fremonti mogollonensis* (p. 256).
cc. Median area of upper and under side of tail broad and distinct, yellowish ochraceous above and grayish white below; general color of body slightly yellower and less rufescent above. *Sciurus fremonti grahamensis* (p. 261).
bb. Pelage mostly grayish above------------------*Sciurus mearnsi* (p. 262).
aa. Total length more than 400 mm.
d. Ears conspicuously tufted; sides with a line of black separating the colors of the upper and lower surfaces; under surface of tail white. *Sciurus aberti* (p. 250).
dd. Ears not tufted; sides without a black line; under side of tail white.
e. Under surface of body ochraceous.
f. Upper surface with a black vertebral band; length, 554 mm.; tail, 279; hind foot, 77------------------*Sciurus apache* (p. 270).
ff. Upper surface without a vertebral band; length, 475 mm.; tail, 225; hind foot, 66---------*Sciurus rufiventer texianus* (p. 281).
ee. Under surface of body white.
g. Hair of tail fulvous at base.
h. Back and ears uniform gray; total length less than 500 mm. *Sciurus alleni* (p. 269).
hh. Back and ears rusty yellowish; length more than 500 mm.
i. Rusty band continuous from occiput to root of tail. *Sciurus arizonensis* (p. 273).
ii. Rusty dorsal band interrupted anteriorly. *Sciurus arizonensis huachuca* (p. 277).
gg. Hair of tail gray at base; total length, 575; tail, 290; hind foot, 80------------------*Sciurus griseus anthonyi* (p. 264).

KEY TO SCIURUS FOUND ON THE MEXICAN BOUNDARY LINE, BASED CHIEFLY ON CRANIAL AND DENTAL CHARACTERS.

a. Species having two upper premolars.
b. Total length of skull less than 60 mm.
c. Pelage mostly rufescent above.
d. Median area of upper and under side of tail narrow and obscure, with the color reddish above and gray below. *Sciurus fremonti mogollonensis* (p. 256).

dd. Median area of upper and under side of tail broad and distinct, yellowish ochraceous above and grayish white below; general color slightly yellower and less rufescent above. *Sciurus fremonti grahamensis* (p. 261).

ee. Pelage mostly grayish above............... *Sciurus mearnsi* (p. 262).

bb. Total length of skull more than 60 mm.

e. *pm*¹ large; interpterygoid fossa short, about equaling the three upper true molars; incisive foramina short, nearly as wide as long; skull measuring 61 by 36 mm................... *Sciurus aberti* (p. 250).

ee. *pm*¹ small; interpterygoid fossa longer, measuring, from base of pterygoid, more than the three upper true molars. Skull measuring 68 by 39 mm............................ *Sciurus griseus anthonyi* (p. 264).

aa. Species with only one upper premolar.

f. Size small.

g. Skull measuring 51 by 34 mm. in greatest dimensions. *Sciurus alleni* (p. 269).

gg. Skull measuring 61 by 35 mm. in greatest diameters. *Sciurus rufiventer texianus* (p. 281).

ff. Larger.

h. Skull high, measuring 63 by 37 to 65 by 38 mm.; brain case inflated and bulging behind the orbits, where the frontal bone forms the anterior portion of its roof.

i. Skull smaller; rusty yellow band continuous from occiput to root of tail........ *Sciurus arizonensis arizonensis* (p. 273).

ii. Skull larger; rusty yellow dorsal band interrupted anteriorly.............. *Sciurus arizonensis huachuca* (p. 277).

hh. Skull low, measuring 65 by 37 mm.; brain case less inflated. *Sciurus apache* (p. 270).

Subgenus **OTOSCIURUS** Nelson (1899).

TUFT-EARED PINE SQUIRRELS.

Otosciurus NELSON, Proc. Washington Acad. Sci., I, p. 28, May 9, 1899.

Dentition.—I. $\frac{1-1}{1-1}$; P. $\frac{2-2}{1-1}$; M. $\frac{3-3}{3-3}$=22

Type.—*Sciurus aberti* Woodhouse.

Type-locality.—San Francisco Mountain, Arizona.

Characters.—Compared with other North American arboreal squirrels, the skull is short and broad; frontal area flattened; brain case depressed, inflated laterally (but less so than in typical *Sciurus*); rostrum and nasals long, the latter equaling interorbital breadth; premolars $\frac{2}{1}$; ears long and broad, very heavily tufted in winter; color usually mainly gray above, white below, with a lateral line more or less distinctly black.

This subgenus is very closely related to typical *Sciurus*, of which *Sciurus vulgaris* Linnaeus is the type, only differing in color, in the greater length of the rostrum, in the more swollen, elevated, and laterally expanded brain case, and the shorter and broader interpterygoid fossa.

SCIURUS ABERTI Woodhouse.

ABERT PINE SQUIRREL.

Sciurus aberti Woodhouse. Proc. Acad. Nat. Sci. Phila., VI, 1852, p. 220 (original description); Sitgreave's Expl. Colorado and Zuñi rivers, 1853, Mam., p. 53, pl. vi.—Audubon and Bachman. Quad. N. Am., III, 1854, p. 262, pl. cliii, fig. 1.—Baird, Mam. N. Am., 1857, p. 267.—Allen, Proc. Bost. Soc. Nat. Hist., XVI, 1864, p. 287; Monogr. N. Am. Rodentia, 1877, p. 735; Bull. Am. Mus. Nat. Hist., VII, 1895, p. 244.—Coues, Amer. Nat., I, 1867, p. 355.—Coues and Yarrow, Wheeler Surv., V, Zool., 1876, p. 115.—Merriam, North American Fauna, No. 3, 1890, p. 49.—Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 57, fig. 13 (Synop. Mam. N. Am.).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, December, 1901, p. 31 (Syst. Results Study N. Am. Mam. to close of 1900).

Sciurus dorsalis Woodhouse, Proc. Acad. Nat. Sci. Phila., VI, 1852, p. 110 (not *S. dorsalis* of Gray).

Sciurus castanotus Baird, Proc. Acad. Nat. Sci. Phila., VII, 1855, p. 332. (Typ. error for *castanonotus*. From Copper Mines, New Mexico.)

Sciurus castanonotus Baird, Mam. N. Am., 1857, p. 266; Rep. U. S. Mex. Bound. Surv., II, Pt. 2, Mam. 1859, p. 35, pl. v.

Mă-qui -hĭ-tä of the Hualapai Indians of northern Arizona.

Sçha-gheru -ŭh of the Hopi Indians of northeastern Arizona.

Type-locality.—San Francisco Mountain, Arizona. (Type. skin without skull. Cat. No. 2430, U.S.N.M.)

Geographical range.—The pine-covered plateaus and mountains of northeastern Arizona, between the spruce and piñon zones, ranging eastward into New Mexico. It occupies the Transition Zone.

Description.—About the size of the northeastern gray squirrel. Color plumbeous-gray above, with a broad dorsal area of reddish brown; under surfaces, including the tail, pure white; sides of body with a black line separating the gray of the upper surface from the white of the under surface; tail black at tip, mixed gray and black above, and white beneath. Ears long and pointed; in winter with chestnut hair at base, and blackish ear tufts more than an inch in length. Length, 500 mm.; tail to end of vertebræ, 220; tail to end of hairs, 280; length of hind foot, 73; ear from crown, 35; ear from notch, 44; length of ear tufts, 38; length of head, 67; distance from nose to eye, 31; nose to ear, 53.

Cranial and dental characters.—The skull, which measures 61 by 36 mm. in its greatest diameters, is relatively short, convex above, with generally rounded contours. The postorbital processes are long and divergent, not sharply deflected as in *Parasciurus*. First upper premolar (which I found wanting in one specimen) considerably larger than the corresponding tooth in *Sciurus fossor anthonyi*. Interpterygoid fossa short, about equaling the three upper true molars. Incisive foramen short, almost as wide as long. Upper molars all 3-rooted; lower molars 4-rooted, except the last, in which the posterior pair of roots are sometimes united, as in the case of the premolar.

Remarks.—The seasonal changes in the coating of the ears correspond so closely with those described in the common squirrel of England, by Mr. Oldfield Thomas,[a] that I can not forbear quoting his remarks:

> The hairs of the ear tufts follow very much in their changes those of the tail. The terminal hairs of the ear tip belonging, like the brush hairs, to the autumnal coat, lengthen and become noticeable in September, attaining their maximum about January. Like the tail hairs, they steadily bleach all the time from their original dark-brown color, and get white, thin, and poor in May and June. In most specimens they have altogether disappeared by July, although in rare cases a few straggling white hairs may remain in position even up to the time that in September the tips of the new tufts begin to show themselves. When tufts of fair size do persist into August, their pure white color renders them very striking objects. Such hairs as may grow on the ear tips at the time of the spring body molt only become visible on the fall of the long tufts, and always remain quite short. The short hairs may in fact be compared to the aborted summer tail covering, already referred to, just as the long tufts of the autumn suit correspond to the autumn brush hairs of the tail.

The chickarees have short ear-tufts in winter, but the Abert pine squirrel is the only one of our species which has these appendages developed to the same extent as the squirrel of England. In this species the ear-tufts fade in summer to brown instead of white.

Life history.—The Abert pine squirrel, on account of its resemblance to the typical Sciuri of the Old World, is doubtless of Asiatic origin, like the chipmunks of the genus *Eutamias*. In the United States it is known only from Arizona, New Mexico, and Colorado, being an inhabitant of the southern Rocky Mountains and of the isolated mountains which rise from the Colorado plateau in Arizona and New Mexico. Along the Mexican line the most careful search failed to discover its presence, though Dr. J. A. Allen has recorded its capture on the upper Bavispee River, in northern Mexico, by the members of the Lumholtz Archæological Expedition, 1890–1892, and Mr. Oldfield Thomas has named the subspecies *durangi*,[b] from Durango, in central Mexico.

Its habitat is restricted to those portions of this area which are covered by coniferous forests. In Arizona it is confined to the belt of pine timber, for the most part included between the altitudes of 5,000 and 8,000 feet.

This handsome squirrel was first described in the Proceedings of the Philadelphia Academy of Natural Sciences in 1852 by Dr. S. W. Woodhouse, who accompanied Captain Sitgreaves on the exploration of the Zuñi and Colorado rivers and obtained specimens in the San Francisco Mountain, then included in the Territory known as New Mexico, at present in Arizona.

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[a] The Zoologist, 3d ser., XX, November, 1896, p. 404.

[b] *Sciurus aberti durangi* Thomas, Annals and Magazine of Natural History, 6th ser., XI, January, 1893, pp. 49, 50.

The Abert squirrel is quite certain to attract the notice of even the most indifferent observer traveling through the wooded mountains of Arizona, where it is generally abundant and seldom shy. I first met with it on one of General Crook's expeditions, which I accompanied in 1884, when it was found in abundance in the Mogollon Mountains, between Forts Verde and Apache. It was noted as soon as we entered the pine forest. The first one was seen running along upon the grassy turf. It "treed," after a brief pursuit, and was shot in the lower branches of one of the superb pines which are the glory of the Arizona forests. Thenceforth it furnished the hunters of our party with sport and agreeably supplemented our daily fare; indeed, under the régime of a clever camp cook it proved to be the favorite dish, although the menu included venison, bear meat, turkey, and pigeon, variously served. Notwithstanding several shotguns were in use, the largest bag of small game was usually found beside General Crook's saddle when camp was reached after the day's march, all having been killed with the rifle. The bag usually contained a bunch of squirrels, each bearing the characteristic mark of the general's small rifle bullet in the back of the head, while the turkeys and pigeons were mostly decapitated by the same diminutive missile. One day the hospital steward brought me a nearly black specimen, with a message from the general, saying that he had shot it with as little mutilation as possible, supposing I would like to preserve it. Among many hundreds of these squirrels since seen I have never noted another melanistic specimen, although some Apache Indians, who afterwards acted as guides to our party, informed me that black or blackish examples were by no means uncommon around Fort Apache. In Colorado melanistic phases of the subspecies *ferreus*[a] are common, and Dr. J. A. Allen notes a black specimen in his material, from the Apache Mountains, Arizona.

If not molested, this squirrel is quite gentle, and its habits easily observed, but, when thoroughly frightened, it is an adept at hiding. It would seem that its bushy tail, white beneath, would betray its whereabouts directly; but it can flatten itself out upon the upper side of a limb so adroitly as to be hard to detect, even when the eye has chanced to fall directly upon it. If fired upon, it often betakes itself to the tree-top, clinging motionless to the topmost bough, where it is often so far above the ground as to be beyond the range of shotguns and not apt to be discovered. These mature pine forests, unlike the spruce woods, are quite open, the trees being often too scattered to allow the squirrels to pass from the branches of one tree to those of another, and frequently they are obliged to descend to the ground in order to reach a neighboring tree. If intercepted by a horseman in its passage from one tree to another it will stop and flatten itself upon the ground and watch the rider, and I have known it to allow itself to be struck with a whip rather than deviate from the course it meant to pursue. Seizing a favorable opportunity it dashes for the tree which it originally intended to climb and seeks concealment and safety among its lofty branches. It seldom enters holes in the trunk or branches of the pines, but prefers, when pursued by its natural enemies, to trust to its dexterity in whisking around to the opposite side and then hiding.

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[a] *Sciurus aberti ferreus* True, Proc. Biol. Soc. Wash., XIII, 1900, p. 183.

At times this squirrel is somewhat gregarious. Frequently an entire family may be seen running together upon the ground, or a half dozen enjoying a frolic in a pine tree. In May, which is the rutting season, whole troops of males are commonly seen chasing the females.

I spent the latter part of May, 1887, in examining the fauna at the summit of the Mogollon Mountains, being camped on the old star-route wagon pass. While there we experienced rain storms almost every day, and occasional flurries of snow, after which the sun would shine forth warm and bright. After these unseasonable "April showers" every living creature on the mountain seemed filled with unwonted excitement and activity. The woods resounded with bird choruses, turkeys gobbled on the neighboring hillsides, and the smaller squirrels chattered and chippered in concert. Then the Abert squirrels were sure to come trooping about our camp, and their cries—a loud squall resembling that of the eastern gray squirrel—mingled with the general medley of sounds. I have a note that my men shot with their carbines from a single pine tree 11 Abert squirrels, all of which were males, and that 47 were eaten by our party in that one camp. They were first parboiled, and then fried in batter. The flesh is light and delicate.

At Humphreys Peak, the highest point of land in Arizona, the Abert squirrel only penetrates the fir and spruce forest as far as scattered pines occur. The greatest altitude at which I found it was nearly 9,000 feet.

When in the San Francisco forest, early in June, I heard some long-crested jays scolding with their usual spirit in a pine tree. On walking to the spot I saw a nest and began climbing the tree. When halfway up, the owner of the nest, which proved to be an Abert squirrel instead of the long-crested jays, passed me, coming down on a neighboring trunk. We both stopped, when about to pass, and took a good look at each other. I felt a supreme disgust at my taxidermic productions when I looked at the living creature within a few feet of me. The squirrel had taken forcible possession of the jays' unfinished nest and had built a round nest upon it, composed entirely of clumps of wire grass pulled up by the roots, having an entrance at the side.

The young are brought forth during the period from May to August, inclusive, the time varying somewhat with the altitude. The nests are placed in the branches of the pines, frequently resting upon an old jay's nest. They are usually constructed of terminal pine boughs, lined with dry grass. It is probable that two litters are sometimes raised in a season. The number of young was determined in three instances. A female, taken on the summit of the Mogollon Mountains May 27, 1887, contained three young, and three and four fetuses, respectively, were found in the uteri of two specimens taken at Pine Tanks, at the lower border of the pine forest, 30 miles north of Fort Verde, on June 19 of the same year. At Bakers Butte young were running in the trees by the middle of the following month.

This species is active throughout the year, but inclined to lie quiet during heavy storms and severely cold winter weather. Its food consists mainly of the seeds of the pine, acorns of the deciduous oaks, groundnuts (*Aralia*), and green vegetation in summer. I once saw one running in the trail ahead of me, carrying a very large, white mushroom in its mouth. I halted to watch it, when it ascended a pine tree and began eating the mushroom voraciously. By the latter part of July the pine cones have nearly attained their full size and the seeds are sufficiently mature for the squirrels to begin feeding upon them. Under every prolific pine visited by this squirrel green chips from the cones may then be seen lying, together with the central cores. The hunter can often locate the squirrels by observing the chips as they come whirling down from the trees and by the sound made in tearing the cones in pieces. I have never seen the Abert squirrel engaged in hoarding up food, and suppose that it leaves the morrow to care for itself. The stores preserved by the provident *carpentero*, or Mexican woodpecker (*Melanerpes formicivorous*), are appropriated by it whenever found, and beyond doubt these caches relieve it at times from extremities of want when the ground is deeply covered with snow and the pine cones mostly fallen or divested of their seeds. The Mormon settlers of Pine Creek informed me that the Abert squirrel commits some depredations on their crops of Indian corn, eating both green and ripe ears, but that it does much less damage than the Rocky Mountain line-tailed ground squirrel (*Citellus grammurus*).

I suspect that the Abert squirrel sometimes interferes with the nests of birds. On July 21, 1886, when camping near Flagstaff, Arizona, a pair of western robins had established themselves in a young pine tree close by, the nest being placed about 20 feet above the ground. One morning there was a great outcry from the birds, and I found them furiously assaulting a large squirrel, which they drove away, whereupon I completed their victory by shooting it.

In May, 1887, a smart contest between a pair of red-backed juncos and an Abert squirrel was witnessed near Mormon Lake, and I have also seen fierce attacks made upon this squirrel by infuriated long-crested jays, whose jealousy of intrusions about their premises is always conspicuous. The Mexican woodpecker and Abert squirrel have unending and vociferous quarrels and feuds over the latter's propensity for pilfering from the hoards of nuts stored in the pine bark by the busy woodpecker, and scold, berate, and belabor each other soundly.

The Abert pine squirrel is very plentiful in Bill Williams Mountain, Arizona.

Measurements of 29 specimens of Sciurus aberti.

Museum number.[b]		Original number.	Sex and age.	Locality.	Date.	Length.	Tail to end of vertebræ.	Length of hindfoot.	Ear from crown.
Skin.	Skull.								
						mm.	*mm.*	*mm.*	*mm.*
2309	([a])	138	♂ ad.	Mogollon Mountains, Arizona	Oct. 5, 1884	498	208	64	35
12175	([a])	139	♂ ad.	do	do	470	200	61	35
2310	([a])	140	♀ ad.	Canyon Creek, Tonto Basin, Arizona	Oct. 7, 1884	473	210	66	36
2311	([a])	141	♂ ad.	Cibicu Creek, Arizona	Oct. 8, 1884	520	235	67	31
12173	([a])	144	♀ ad.	Pine Creek Settlement, Mogollon Mountains, Arizona	Oct. 25, 1884	510	230	69	36
12172	([a])	145	♀ ad.	Strawberry Valley, Mogollon Mountains, Arizona	do	524	234	70	40
....	1670	420	♀ ad.	Flagstaff, Arizona	June 21, 1886	480	215	74	35
....	1669	421	♂ ad.	do	do	470	217	70	36
....	1665	422	♀ ad.	Munds's Ranch, San Francisco Forest, Arizona	June 19, 1886	475	210	....	35
2312	1684	429	♂ ad.	Near Bakers Butte, Mogollon Mountains, Arizona	July 3, 1886	480	230	71	33
2312	1685	468	♂ ad.	Strawberry Valley, Mogollon Mountains, Arizona	Oct. 25, 1886	503	228	72	35
2316	1681	533	♂ ad.	Stonemans Lake, Mogollon Mountains, Arizona	May 22, 1887	504	227	75	36
2317	1693	534	♀ ad.	do	May 23, 1887	495	222	74	36
3736	1683	535	♀ ad.	do	do	502	240	75	38
2318	1672	554	♀ ad.	Quaking Asp Settlement, Mogollon Mountains, Arizona	May 27, 1887	501	237	74	33
2319	1671	555	♀ ad.	do	do	510	.....	71	32
2320	1677	556	♀ ad.	do	do	521	240	75	36
2321	1688	557	♀ ad.	do	do	509	243	73	38
3735	1687	565	♀ ad.	do	May 28, 1887	505	240	69	36
2322	1686	566	♀ ad.	do	do	491	214	71	36
2323	1680	567	♂ ad.	do	do	508	240	70	36
3732	1678	568	♀ ad.	do	do	507	235	74	35
3733	1679	577	♀ ad.	Hart's Ranch, San Francisco Mountains, Arizona	June 3, 1887	485	230	75	32
3731	1682	583	♀ ad.	San Francisco Mountains, Arizona	June 8, 1887	513	215	74	36
12176	1668	600	♂ ad.	Bakers Butte, Mogollon Mountains, Arizona	July 12, 1887	517	242	71	35
2307	1676	601	♂ ad.	do	July 13, 1887	485	220	70	34
....	1675	602	♂ ad.	do	do	475	218	74	33
....	1674	606	♂ ad.	do	July 11, 1887	530	237	76	35
....	1673	621	♀ ad.	do	Aug. 3, 1887	523	237	77	35

[a] In skin.

[b] American Museum of Natural History.

Subgenus **TAMIASCIURUS** Trouessart (1880).

CHICKAREES OR RED SQUIRRELS.

Dentition.—I. $\frac{1-1}{1-1}$; P. $\frac{2-2}{1-1}$; M. $\frac{3-3}{3-3}=22$.

Squirrels of small size [Chickarees]; tail narrow, even including the hairs, shorter than the body; muzzle short; hind feet, in summer, naked beneath for one-half or one-third their length from the heel; anterior small upper molar either wanting or, when persistent, very small and thread-like; a black stripe on the flanks; back of the ears more or less tufted in winter. (*S. F. Baird.*)

SCIURUS FREMONTI MOGOLLONENSIS (Mearns).

MOGOLLON CHICKAREE.

Sciurus hudsonius mogollonensis Mearns, Bull. Am. Mus. Nat. Hist., II, p. 277, Feb. 21, 1890 (original description).

Sciurus fremonti mogollonensis, Merriam, North American Fauna, No. 3, 1890, p. 48 (San Francisco Mountain, Arizona).—Allen, Bull. Am. Mus. Nat. Hist., X, July 22, 1898, p. 291 (Revision of the Chickarees or North American Red Squirrels).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 34 (Syst. Results Study N. Am. Mam. to close of 1900).

Sciurus hudsonicus mogollonensis, Allen, Bull. Am. Mus. Nat. Hist., VII, 1895, p. 243 (White Mountains, Arizona).

[*Sciurus fremonti*] *mogollonensis*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 67 (Synop. Mam. N. Am.).

Hĭm-măl'-ē-gă-tä of the Hualapai Indians of Arizona.

Kŏll'-chē-ow-ĕh' of the Hopi Indians of northeastern Arizona.

Type-locality.—Mogollon Mountains, central Arizona. (Type in the American Museum of Natural History.)

Geographical range.—Boreal Zone of Mountains of the Colorado Plateau, in northeastern Arizona.

Description.—Similar to *Sciurus fremonti* Audubon and Bachman, but redder and larger. Like other chickarees (Subgenus *Tamiasciurus*), it has a reddish dorsal stripe in winter, but not in summer; also differently colored feet. In winter the color of the upper surface is reddish centrally from the occiput to the base of the tail, finely mixed with black and grizzled on the sides, which become more grayish low down and on the outer aspect of the thighs; black line of sides indicated, though not strongly pronounced; coloring of limbs externally much like the sides, except the feet, which are whitish, sprinkled with black and fulvous hairs; fore part of head grayish, becoming dusky on the forehead; under surfaces (except the tail), a circle around eye, and end of nose except a narrow blackish line above, white; entire pelage plumbeous at base; that below appearing plumbeous on the surface, in places, where the white tips have been worn away; tail, viewed beneath, gray centrally, bordered with black, succeeded by grayish white, and gray all round at base; the black lateral stripes beginning narrowly, and gradually encroaching on the gray central stripes until the latter becomes obliterated at the extremity, which is nearly all black; the 5-striped pattern of the tail is less distinct above, and the central area is reddish. The slightly developed ear-tufts are dusky, and the long, full whiskers jet black. It has four pairs of mammæ. Length, 375 mm.; tail vertebræ, 140; tail to end of hairs, 185; hind foot, 55; ear from crown, 21; ear from notch, 30; length of head, 56; distance from nose to eye, 25; to ear, 45. Skull, 50 by 29 mm.

Cranial and dental characters.—In common with other members of the subgenus *Tamiasciurus*, the dental formula is $i\frac{1}{1}\frac{1}{1}$; $pm\frac{2}{1}\frac{2}{1}$; $m\frac{3-3}{3-3}=\frac{12}{10}=22$, a minute and functionless premolar being present in nine of the thirteen skulls examined. This form has the largest skull of any of the known members of the subgenus *Tamiasciurus*.

Life history.—To the naturalist, the meeting of a strange animal in its native haunts is attended by a thrill of enthusiastic delight, but my introduction to this beautiful squirrel was under circumstances lending added piquancy to the episode. In October of 1884 I accompanied, as medical officer, a small command of cavalry under the leadership of Gen. George Crook. It was my first experience of crossing the cordilleras of this subtropical region. The scorched and barren plains of the low country, the broad reaches of grassy mesas, and the difficult slopes bestrewn with scoria, lay behind us; and we were traversing a fairly good mountain road at the summit of the Mogollon Range, in central Arizona. The previous day's ride had carried us well up into the belt of pine timber, and at night we had encamped in a canyon where the first spruce trees were seen. I rode out of camp next morning with my usual weapon, but with one compartment of my shooting vest filled with shells, which were carefully loaded with buckshot. A flock of Mexican turkeys first engaged my attention, and then a succession of new and strange birds and mammals, until my saddle pockets were distended with specimens. Then, belated as usual, I followed the trail of the command, which lay along the summit of the mountain divide, whence one looked down upon the undulating surface of Tonto Basin from the verge of a sheer precipice on one hand, while upon the opposite side was a gentle slope of heavily wooded country, in which a series of tortuous ravines arise, which converge, deepening in their course, to unite far below and form vast canyons. But the ravines alluded to had a special flora of their own. Their shady slopes were covered with large spruces and various deciduous trees, together with a luxuriant undergrowth, covering all the unoccupied spaces. Tying my horse, I plunged into one of these openings that had proven irresistibly tempting. Its dark, mysterious depths were illuminated by a blaze of brilliant coloring, afforded by the foliage of the hard maple and other trees, then resplendent in autumnal tints. As I descended, some plant or shrub of this alpine flora was noted at almost every step, that reminded me of something I had seen many degrees farther north—the velvety, net-veined leaves of an orchis (*Goodyera*). Solomon's seal, bellwort, violet, pyrola, coral root, gooseberry, raspberry, elder purple-flowering raspberry, dewberry, etc. At length, the way became more choked with underbrush, and then I discovered that I had entered the haunts of "bruin." In fact, I was unwittingly following a bear trail through the dense thicket, and bear signs were everywhere visible. Here was a track, there an overturned rock or log where the bears had been searching for the insects upon which they delight to feast, and even the spot where one had enjoyed a siesta at the base of a huge spruce. At the sudden dawning of the idea that I was possibly running into close quarters with one or more of these formidable beasts with no better weapon than a shotgun, the feeling of enjoyment and critical interest in my surroundings gave place to one of excitement, if not apprehension. Therefore I loaded with buckshot and moved cautiously forward. Presently a crashing, crackling noise was heard in advance, accompanied by the sound of brushing branches, breaking twigs, and rustling leaves. Crouching in readiness behind a spruce trunk, I imagined the sound was approaching, but it again receded and curiosity led me to follow it. A moment later I was nearly hit on the head by a heavy, green pine cone that came rattling down from a very tall tree top, cracking off dry twigs in its descent, and then rustling among the dry leaves as it rolled down the steep hillside to the bottom of the ravine. This was immediately followed by another, and then another, until I discovered a couple of these active little squirrels industriously engaged in harvesting the large, resinous cones, and quickly brought one little fellow to bag, thereby adding to my collection the third novelty in squirrels on that day. On going forward to pick up the specimen, a pile of cones was discovered which would have filled a flour barrel, and more than an equal quantity lay scattered upon the ground. I think they are usually buried in the ground or in old logs for winter use, as hollow trees are scarce in such places. I afterwards found the ground beneath the trees that they inhabited deeply pitted with holes, into which they were continually digging, late in May, at which season spring is just opening at these high altitudes.

During several succeeding days this squirrel was daily seen in similar ravines, wooded with maple, foxtail pine, fir, and spruce, which localities were inhabited to the exclusion of the more open pine woods. They were busily employed in laying up supplies for their winter larder. The pelage of the specimens taken at this time was much soiled and matted together with pine and spruce gum, which adheres in sticky drops to the ripening fruitage. As we descended to a lower altitude, the firs and spruces were left behind, and with them this chickaree; nor did I meet with it again for nearly three years.

As the Mogollon chickaree only inhabits the fir and spruce forests of Arizona, between the altitudes of 6,500 and 11,500 feet, its habitat would be represented on the map by a few narrow belts and isolated spots, corresponding to the mountain peaks and highest ridges of land in the Territory. Its economic relations with man are therefore unimportant, and may be said to affect the interests of forestry more than those of agriculture, since little attempt has hitherto been made to cultivate the soil at this altitude. Beyond pilfering a few stores from the mountaineer's cabin it is innocent of harm, and it more than compensates for all such peccadillos by the companionship afforded by its familiarity and lively manners.

Early in May, 1887, I pitched my tent beside a beautiful spring on the summit of the wagon pass across the Mogollon Mountains, along the line of the old star-route stage course, formerly running between Santa Fe, New Mexico, and Prescott, Arizona, and went into camp for several days. A better location for observing the habits of this chickaree could not have been selected. The locality was a deep notch between two mountains, and the spring came from the hillside near the lower border of a spruce forest, where there was an admixture of foxtail and yellow pines. The Abert pine squirrel here infringed somewhat upon the territory of the Mogollon chickaree, but I never saw the latter forsake the spruces for the pines, nor did I observe any quarrels between the two species, although I had heard that the chickaree was jealous of any intrusion on the part of its larger neighbor, which it resented by waging instant warfare against it and driving it away.

While at this camp, I instructed the men not to shoot or otherwise molest any of the squirrels near our tents, hoping to gain the confidence and thus learn something of the habits of the various small quadrupeds that were abundant around us. In this I was not disappointed; indeed, it was not long until we were compelled to trap a number of chipmunks, whose audacity knew no bounds, in order to save our supplies. While I was preparing specimens in the shade of a tent fly, the Mogollon chickarees pursued their accustomed avocations within a few feet of me. They were full of curiosity, and by no means diffident. They inspected our tents and equipments generally, even to the horses' nosebags. They came to the spring and drank, and were open and aboveboard in all their actions, unless their fossorial performances savored of mystery. They were continually digging large holes in the loose soil under the spruce trees, apparently in search of hidden food, and their efforts were so far successful, in that they speedily appeared seated upon some horizontal branch, close to the trunk and facing the extremity of the limb, noisily tearing open a cone to get at the seeds. Around the huge boles of the spruce trees large heaps of refuse from the demolished cones attested the industry and vigorous appetites of these squirrels. They are possessed of a large share of the nervous activity and impetuosity which are so characteristic of the eastern red squirrel, which, in general, they resemble in habits. Their voice is nearly the same, and they chatter and scold in the same impulsive fashion.

Late in the month of May we found this squirrel inhabiting the highest points of the mountain chain in this region. It was particularly abundant on Mormon Mountain, whose deep ravines were still filled with snow. Continuing our exploration to the San Francisco Mountain, we found it abundant there from the upper border of the pine belt, which overlaps the fir and spruce zone to the altitude of 10,000 feet, nearly to the upper limit of timber, which is at 11,562 feet altitude. Its nests were found in the last tallish firs and spruces, from which point upward to timber line only stunted, prostrate forms of the same conifers exist, crushed beneath masses of snow and ice that lie upon the summit through the greater part of the year. They also inhabited the deepest, gloomiest ravines, enfolded in the horseshoe outline of this group, where the light of day scarcely penetrates the dense foliage of the evergreens, which lie in shadow most of the day. There, their pert and saucy manners seemed a trifle modified, still they would run down a sloping branch toward me and stamp and scold in their accustomed way. Their coats were somewhat darker in color than in specimens from more open and less shadowed woods. Their nests were similar to those which the red squirrel makes in southern New York.

In August of the same year (1887), this species was found in spruce and maple groves upon north hillsides, in the neighborhood of Bakers Butte, at an altitude of 6,500 feet, and was ascertained to feed to some extent upon the fruitage of the maple.

Measurements of 16 specimens of Sciurus fremonti mogollonensis.

Museum numbers.[a]		Collector's number.	Date.	Locality.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hindfoot.	Ear from crown.
Skin.	Skull.								
			1884.			*mm.*	*mm.*	*mm.*	*mm.*
2295	In skin.	135	Oct. 4	Between Bakers Butte and General Springs, Mogollon Mountains, Arizona.	♀ ad.	327	130	53	20
2296	....do...	136	....do...	.....do	♀ ad.	340	135	55	22
2297	....do...	137	Oct. 5	Between General Springs and Lake Tanks, Mogollon Mountains, Arizona.	♂ ad.	337	127	53	21
			1887.						
2298	....	537	May 23	Quaking Asp Settlement, Mogollon Mountains, Arizona.	♂ ad.	377	143	56	21
2299	1726	538	....do...	.....do	♀ ad.	351	141	52	22
2300	....	543	May 25	.....do	♂ ad.	350	136	54	20
12179	1716	544	....do...	.....do	♂ ad.	334	136	55	18
2301	1724	558	May 27	.....do	♀ ad.	360	152	55	21
2509	1723	559	....do...	.....do	♂ ad.	376	156	55	24
	1722	560	....do...	.....do	♂ ad.	359	157	54	20
	1721	561	....do...	.....do	♂ ad.	361	151	54	24
	1720	562	....do...	.....do	♂ ad.	374	158	56	20
3731	1719	563	May 28	Mormon Lake Mountain, Arizona	♂ ad.	343	142	53	22
2302	1717	579	June 6	San Francisco Mountain, Arizona	♂ ad.	336	128	54	21
12180	1725	611	July 21	Bakers Butte, Mogollon Mountains, Arizona.	♀ ad.	341	140	51	21
	1718	667	Aug. 22	.....do	♂ ad.	360	145	53	22

[a] American Museum of Natural History.

SCIURUS FREMONTI GRAHAMENSIS (Allen).

MOUNT GRAHAM CHICKAREE.

Sciurus hudsonicus grahamensis ALLEN, Bull. Am. Mus. Nat. Hist., VI, p. 350, Dec. 7, 1894 (original description); VII, 1895, p. 244.

Sciurus fremonti grahamensis, ALLEN, Bull. Am. Mus. Nat. Hist., X, p. 292, July 22, 1898 (Revision of the Chickarees or North American Red Squirrels).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 35 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Sciurus fremonti*] *grahamensis*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 67 (Synop. Mam. N. Am.).

Type-locality.—Summit of Graham Mountain, Arizona. (Type, skin and skull, in the American Museum of Natural History, New York.)

Geographical range.—Known only from the type locality.

Description.—"Similar to *S. h. mogollonensis*, but slightly yellower and less rufescent above, with the central area of the lower surface of the tail grayish white from the base to the end of the vertebræ, and the base of the hairs of the middle area of the upper surface of the tail yellowish ochraceous, forming a prominent median band of this color.

A few specimens from the San Francisco and White mountains show a slight tendency to a grayish median area along the lower surface of the tail, but it is never so pronounced and conspicuous as in the specimens from the Graham Mountains. In true *S. h. mogollonensis* the basal portions of the hairs of the upper surface of the tail are more or less fulvous, but as a rule they are not at all pronounced, whereas in the Graham Mountains specimens they are conspicuous features.

"While *S. h. grahamensis* is apparently not a very strongly differentiated form, it seems to well warrant recognition, especially when considered in relation to its fairly isolated habitat. While the White Mountains form merely the eastern end of the elevated pine plateau extending westward to the San Francisco Mountains, the Graham Mountains are south of the plateau region, from which they are separated by a comparatively low arid plain. Mr. Price (in letter of October 12, 1894) writes: 'Finding *Sciurus hudsonius* var.? in the Graham Mountains was interesting. It could not possibly have come in recent times from the White Mountains, as the dry desert of the Gila River lies between. The Graham Mountains rise abruptly from the plain to about 10,500 feet above sea level, and are very isolated.'" (*J. A. Allen.*)

Dimensions.—Average of three adult specimens, of which the measurements are given by Doctor Allen, in tabular form, in the original description: Length, 332 mm.; tail vertebræ, 134; hind foot, 55; ear, 28.

Remarks.—Lieut. Harry C. Benson, writing from Fort Huachuca, Arizona, September 26, 1884, speaks of "squirrels—gray and red (one specimen only seen)." I subsequently heard of a red-backed squirrel that had been shot and skinned in the Huachuca Mountains, about 1893, which I thought possibly *S. aberti*. Both this and Lieutenant Benson's "red" squirrel may have been a form of this chickaree.

Mr. Edward D. Tuttle, clerk of Graham County, writing from Solomonville, Arizona, March 21, 1889, says that this squirrel abounds in the mountains of the Graham Range.

SCIURUS MEARNSI (Townsend).

MEARNS CHICKAREE.

Sciurus hudsonius mearnsi Townsend, Proc. Biol. Soc. Washington, XI, p. 146, June 9, 1897 (original description).

Sciurus hudsonius californicus Allen, Bull. Am. Mus. Nat. Hist., V, p. 199, Aug. 18, 1893. ("One specimen, female adult, San Pedro Martir, altitude 8,200 feet, May 18. This specimen is in very worn pelage, but as nearly as can be judged is referable as above." Collected by Messrs. E. C. Thurber and A. W. Anthony.)

Sciurus mearnsi, Allen, Bull. Am. Mus. Nat. Hist., X, p. 286, July 22, 1898 (Revision of the Chickarees or North American Red Squirrels).

Sciurus douglasi mearnsi, NELSON, Proc. Washington Acad. Sci., I, p. 87, pl. I, fig. 8, May 9, 1899 (Revision of the Squirrels of Mexico and Central America).

Sciurus douglasi mearnsi, MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 34 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Sciurus*] *douglasi mearnsi*, ELLIOT, Field Col. Mus., Zool. Ser., IV, Pt. 1, 1904, p. 133, fig. 21 (skull) (Mam. Mid. Am.).

Type-locality.—San Pedro Martir Mountains, Lower California. (Type, skin and skull (fig. 40), No. $\frac{18266}{25170}$, U. S. National Museum.)

Geographical range.—Boreal zone of mountains of southern and Lower California.

Description.—Three specimens in the U. S. National Museum collection (Nos. $\frac{18265}{25169}$, $\frac{18266}{25170}$, and $\frac{18267}{25171}$), from the San Pedro Martir Mountains, Lower California, collected by Mr. Charles H. Townsend, in April and May, 1889, have the pelage short and coarse, and are distinctly paler and more hoary than *S. hudsonicus californicus* from central California. The April specimen (No. 18265, female adult) has the reddish vertebral stripe tolerably distinct, with yellowish on nape and reddish on rump; but in the two May specimens, probably males, though the sex is not indicated, this is less distinct, the color being pepper-and-salt, suffused with tawny ochraceous above. In all three specimens the black stripe at the side is strongly marked, as much so as in the subspecies *californicus*. The ears are heavily tufted with black. The under parts are white, with plumbeous at base. Feet yellowish white. All three are in winter coat, but molting had begun in No. 18267 and proceeded irregularly over most of the fore limbs. On the mane the new hairs are strongly yellowish instead of soiled white; not molting on hind feet. The tail is short and comparatively short-haired;

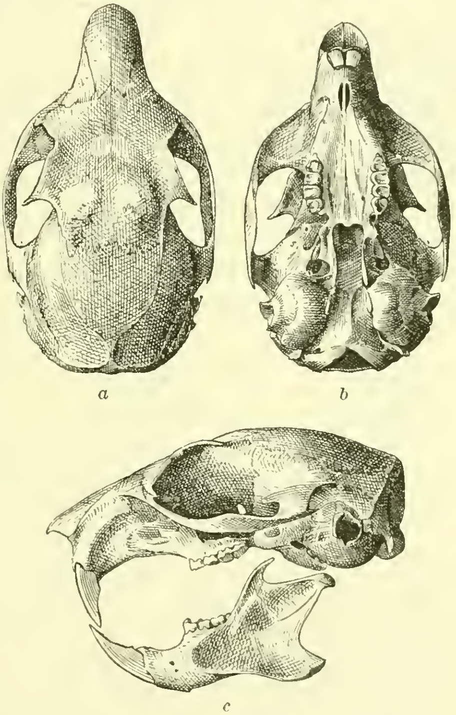

FIG. 40.—SCIURUS MEARNSI. (Type, Cat. No. 25170, U.S. N.M.) *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

black tipped with white on its sides and terminal third, yellowish on median area of upper surface, and grayish on the corresponding part of the under surface.

Remarks.—This chickaree was not seen alive, though it is said to occur at times on the Laguna and Cuyamaca Mountains, 15 to 20 miles north of the Mexican line in southern California. Skins were brought to Campo, near Monument No. 240, which were said to have been taken at Laguna Grande, about 50 miles farther south, in the mountains of Lower California. Doctor J. A. Allen regards this as a species; Mr. Nelson as a subspecies of *Sciurus douglasii.* Its relationships can not be finally determined until specimens have been obtained from intermediate localities.

Subgenus **HESPEROSCIURUS** Nelson (1898).

WESTERN GRAY SQUIRRELS.

Dentition.—I. $\frac{1-1}{1-1}$; P. $\frac{2-2}{1-1}$; M. $\frac{3-3}{3-3}=22$.

Without ear-tufts; interpterygoid fossa shorter than in *Parasciurus*, longer than in *Sciurus;* premolars, $\frac{2}{1}$; the anterior upper premolar smaller than in *Sciurus*, larger than in *Tamiasciurus;* molar teeth unusually robust; skull similar to that of *Neosciurus*, but broadened posteriorly and more depressed, with the zygomatic process of squamosal thrown out horizontally, and the zygomatic arch inclined less obliquely upward.

SCIURUS GRISEUS ANTHONYI (Mearns).

ANTHONY GRAY SQUIRREL.

Sciurus fossor anthonyi Mearns, Proc. U. S. Nat. Mus., XX, 1898, p. 501 (pp. 1, 2 of advance sheet issued March 5, 1897; original description).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 300 (Syst. Results Study N. Am. Mam. to close of 1900).

Sciurus fossor, Allen, Monogr. N. Am. Rodentia, 1877, p. 731 (in small part; only as to No. 3633, from Fort Tejon, southern California).

Sciurus griseus, Nelson, Proc. Washington Acad. Sci., I, p. 83, May 9, 1898 (part).

[*Sciurus griseus*] *anthonyi*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 57 (Synop. Mam. N. Am.).

[*Sciurus*] *griseus*, Elliot, Field Col. Mus., Zool. Ser., IV, Pt. 1, 1904, p. 130 (Mam. Mid. Am.).

Type-locality.—Campbell's ranch, Laguna Mountains, San Diego County, California. (Type, skin and skull, No. 60928, U.S.N.M.)

Geographical range.—Transition zone of mountains of the interior of southern and Lower California.

Description.—Largest of the tree squirrels (*Sciuri*) on the Mexican Border of the United States. Length, 570 mm.; tail to end of vertebræ, 290; tail to end of hairs, 370; width of outspread hairs of tail, 140; length of hind foot, 80; ear from crown, 28. Color gray above, very faintly suffused with yellowish brown on the back. Tail gray above, the hairs very broadly annulated with black and tipped with white; tail below, tricolor, grayish mesially, then broadly banded with black and edged with white. Feet (fig. 41) mixed yellowish brown, gray, and black, the latter predominating on the toes. Ears scantily coated with grayish hair, the color changing to tawny ochraceous at base externally. Cheeks gray, mixed with white. Under parts, inner side of limbs, and orbital circle white. Mammæ: P. $\frac{1}{1}$, A. $\frac{2}{2}$, I. $\frac{1}{1}$=4 pairs.

Cranial and dental characters.—The skull (fig. 42) averages 68 by 39 mm. in its greatest diameters. It is relatively long and high, though somewhat flattened in the frontal region. Nasals convex and prominent anteriorly, giving increased height to the rostrum. First upper premoler small. Incisive foraman short. Interterygoid fossa short, but relatively longer than in *Sciurus aberti*, measuring (from base of pterygoid) more than three upper true molars taken together.

Remarks.—The description of the two recognized subspecies of *Sciurus griseus* were foreshadowed by the writings of Dr. J. A. Allen, in the Monographs of North American Rodentia, published in 1877, where he observes (p. 731): "This species is remarkable for the constancy of its coloration. Among some thirty specimens before me only two depart much from the normal phase, as above described. One is No. 2463, from near San Francisco, which is faintly washed above with pale reddish brown. The other is No. 3633, from Fort Tejon," etc. Both of these specimens are still in the U. S. National Museum collection. The first (No. 2463) is a typical specimen of Mr. Bryant's *Sciurus griseus nigripes*,[a] and the second (No. 3633) is

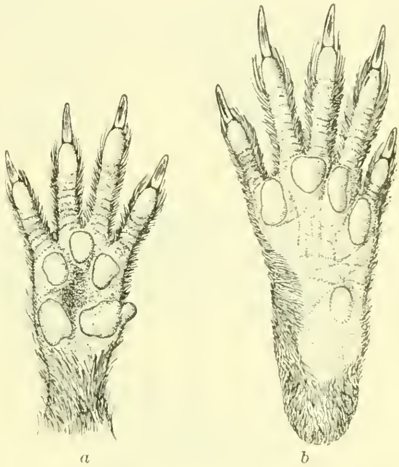

FIG. 41.—SCIURUS GRISEUS ANTHONYI, LAGUNA MOUNTAINS, CALIFORNIA. (Cat. No. 61638, U.S.N.M.) *a*, FOREFOOT; *b*, HINDFOOT.

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[a] Proceedings of the California Academy of Sciences, second series, II, 1889, p. 25. The description reads as follows: "During the fall of 1888 I examined about twenty specimens of this new variety in the flesh from San Mateo County and about the same number of *S. fossor* from the foothills of the Sierra Nevada, as they were offered on sale in the markets. There is no trouble to recognize at a glance the differences which are so strongly marked in the gray squirrels of the Sierra region and those of the redwood coast region south of San Francisco. Subsp. char.—General color of upper parts much

S. g. anthonyi. Topotypes of the latter from San Mateo County, California, are much darker than true *S. griseus;* the top of the head and upper surface of the tail are blackish, and the back is strongly suffused with yellowish brown. The subspecies *anthonyi*, from the mountains of the interior of southern and Lower California, is very much paler than *S. griseus* (typical) and also smaller. The tawny-ochraceous color at base and posterior surface of ear is present in all three forms in winter and absent from the summer pelage, as in *S. arizonensis* and other species of squirrels. In summer *S. g. nigripes* has blacker feet than either of the other forms, but in all three the amount of black is least in winter.

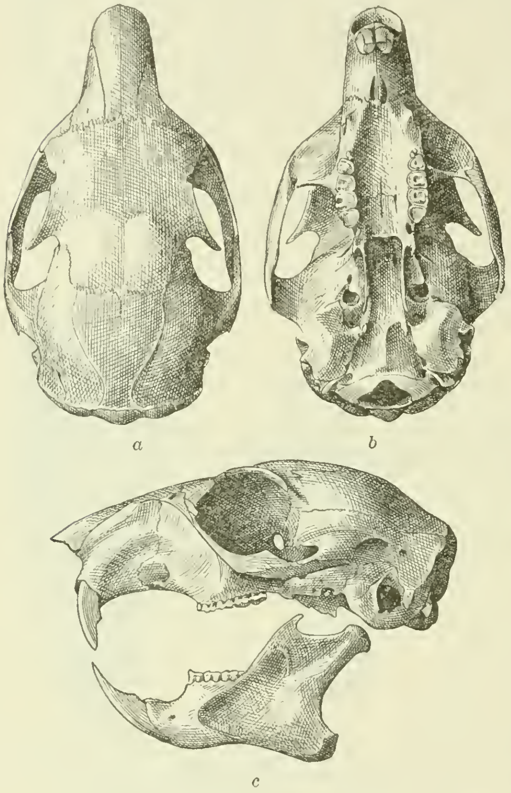

Fig. 42.—Sciurus griseus anthonyi. San Diego County, California. (Cat. No. 60934, U.S.N.M.) *a*, Dorsal view; *b*, ventral view; *c*, lateral view.

Remarks.—When engaged upon his Revision of the Squirrels of Mexico and Central America, one of the best papers ever written upon American mammals, Mr. Nelson was puzzled by the interrelations of the present form with typical *griseus* and the subspecies *nigripes*, and regarded *anthonyi* as an untenable race and a direct intergrade between *griseus* of Columbia River Valley and *nigripes* of the redwood belt in San Mateo County, on the coast of California south of San Francisco; but we have recently reviewed the case together, and Mr. Nelson agrees with me that *anthonyi* is a

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darker than *S. fossor*, particularly upper surface of tail. Upper surface of manus, dark gray or black. Upper surface of pes black, sometimes with a sprinkling of gray on toes. Entire absence (on majority of specimens) of light tawny ochraceous at base and posterior surface of ears. Dorsal region and scapulars marked by a pale yellowish-brown suffusion extending nearly or quite to the tail. Orbital ring and under surface of body and legs pure white. Habitat.—Coast region of California south of San Francisco."

divergent form, more closely related to *nigripes* than to *griseus*, from which latter it may be recognized by the following characters: Size smaller; color paler and less coarsely grizzled; pure white instead of faintly yellowish on under parts; sides of head paler, with hairs less annulated with black; feet and tail much blacker; ears narrower and much longer; feet and claws smaller; skull smaller (averaging 68 by 39 mm. in *anthonyi* against 70 by 38 in topotypes of *griseus*), with relatively shorter and broader rostrum and nasals, and very slightly higher audital bullæ.[a]

From *Sciurus griseus nigripes* it is only distinguishable by slightly smaller size, paler coloration, and absence of the yellowish-brown suffusion over the back. *S. g. nigripes* is the darkest, and *S. g. anthonyi* the palest form; but the shape of the skull and ears and the color of the feet and tail are very similar.

I have seen specimens of this form from the oak zone of the Laguna, Cuyamaca, San Jacinto, San Bernardino, and Tejon mountains of southern California, its range extending south at least to the Laguna Mountains of Lower California, 50 miles south of Campo, and 70 miles south of the type-locality in San Diego County, California.

Habits and local distribution.—Our specimens were all obtained from the type-locality. It was usually seen in pine and oak trees, often descending to the ground. The young are probably born in May and June, as we obtained a female with her two young on June 12, and obtained a very young one June 19.

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[a] In addition to the facts of the present case, I will say that, according to recently-applied standards, no native mammal of the Columbia River Valley is subspecifically identical with the same species from any part of Mexico, so far as my comparisons have gone.

Measurements of 22 specimens of Sciurus griseus anthonyi.

Museum numbers. Skin.	Museum numbers. Skull.	Collector's number.	Sex and age.	Locality.	Date.	Length.	Tail to end of vertebræ.	Length of hindfoot.	Ear from crown.
					1894.	*mm.*	*mm.*	*mm.*	*mm.*
60924	60924	3638	♀ ad.	Camp No. 92, at Laguna, San Diego County, California.	June 10	595	305	84	28
60925	60925	3639	♀ ad.	.....do	....do...	575	290	82	27
60926	60926	3640	♀ ad.	.....do	....do...	570	286	82	28
60927	60927	3641	♀ ad.	.....do	....do...	550	276	78	28
60928	60928	3642	♀ ad.	.....do.[b]	....do...	540	270	79	28
60929	60929	3644	♂ juv.	.....do	June 11	......	......	......	......
60930	60930	3645	♂ ad.	.....do	....do...	560	275	79	27
60932	60932	3664	♂ juv.	.....do	June 15	435	......	......	......
60933	60933	3668	♀ ad.	.....do	June 16	570	308	81	27
60934	60934	3669	♀ ad.	.....do	....do...	585	295	81	28
60935	60935	3672	♂ ad.	.....do	....do...	570	290	80	28
60936	60936	3673	♂ ad.	.....do	....do...	570	280	82	30
60889	60889	1426	♂ ad.	.....do	June 9	560	275	77	26
60890	60890	1433	♀ ad.	.....do	June 11	575	290	80	27
60894	60894	1437	♀ ad.	.....do	June 12	570	287	83	29
60893	60893	1456	♀ ad.	.....do	June 15	568	290	78	28
60895	60895	1467	♀ ad.	.....do	June 17	568	282	80	26
[a]8263	6602	1432	♀ ad.	.....do	June 11	580	373	82	27
[a]8264	6603	1434	♀ ad.	.....do	June 12	570	287	......	27
[a]8265	6604	1436	♀ ad.	.....do	....do...	590	290	85	30
[a]8269	6608	1455	♂ ad.	.....do	June 15	575	290	82	28
[a]8270	6609	1466	♀ ad.	.....do	June 16	550	280	80	28

[a] American Museum of Natural History.

[b] Type.

Subgenus **ARÆOSCIURUS** Nelson (1899).

SLENDER SQUIRRELS.

Aræosciurus Nelson, Proc. Washington Acad. Sci., I, p. 29, pl. 1, fig. 3, May 9, 1899 (Revision of the Squirrels of Mexico and Central America).

Dentition.—I. $\frac{1-1}{1-1}$; P. $\frac{1-1}{1-1}$; M. $\frac{3-3}{3-3} = 20$.

The following is the original description:

Type *Sciurus oculatus* Peters, from eastern Mexico.

Distribution.—Mountains bordering the table-land of Mexico from the volcanoes of Orizaba and Toluca north to central Arizona and west-central New Mexico. Transition zone.

External characters.—Size large; body rather slender; tail usually long, sometimes exceeding length of head and body; upper parts gray or yellowish; underparts white or yellowish.

Cranial characters.—Premolars $\frac{1}{1}$. Skull rather short, depressed; brain case broadened at parietals; occiput low and broad; front of skull depressed at base of rostrum (more arched in *Parasciurus*); rostrum light; nasals narrow, slightly tapering posteriorly; upper end of premaxillæ narrow.

General notes.—The subgenus *Araeosciurus* is characteristic of the transition zone in the mountains bordering the table-land of Mexico from Mts. Orizaba and Toluca northward. It is intrusive in the United States, where it is represented in Arizona and western New Mexico by a single species, *S. arizonensis*. The group is most nearly related to *Parasciurus*, from which the skull characters distinguish it. The following species and subspecies belong to this subgenus: *S. oculatus*, *S. o. tolucæ*, *S. alleni*, *S. nayaritensis*, *S. apache*, *S. arizonensis*, and *S. a. huachuca*. (Proc. Wash. Acad. Sci., I, 1899, p. 29.)

SCIURUS ALLENI Nelson.

ALLEN SQUIRREL.

"*Sciurus carolinensis? ?*" Baird, Mam. N. Am., 1857, pp. 263, 264 (Santa Catarina, Nuevo Leon, Mexico).

Sciurus carolinensis var. *carolinensis*, Allen, Mon. N. Am. Rodentia, 1877, pp. 706–709, 716 (part: from Nuevo Leon, Mexico).

Sciurus carolinensis, Alston, Proc. Zool. Soc. London, 1878, pp. 658–659; Biol. Cent.-Am., Mam., pp. 124, 125, June, 1880 (part: from Nuevo Leon, Mexico).

Sciurus arizonensis, Allen, Bull. Am. Mus. Nat. Hist., N. Y., III, May, 1891, p. 222 (part: from San Pedro mines, Nuevo Leon, Mexico).

Sciurus alleni Nelson, Proc. Biol. Soc. Washington, XII, 1898, pp. 147, 148, June 3; Proc. Washington Acad. Sci., I, 1899, p. 91, May 9 (Revision of the Squirrels of Mexico and Central America).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, Pt. 1, Dec. 27, 1901, p. 35 (Syst. Results Study N. Am. Mam. to close of 1900).—Elliot, Field Col. Mus., Zool. Ser., IV, Pt. 1, 1904, p. 108 (Mam. Mid. Am.).

As long ago as 1857 Baird suspected that this species might be distinct from the common eastern gray squirrel to which it bears a very close resemblance externally. Lack of material for comparison prevented him from naming it, however, and it was first described by Nelson as follows:

Type-locality.—Monterey, Nuevo Leon, Mexico. Type no. $\frac{25731}{33131}$ U. S. National Museum, Biological Survey collection.

Distribution.—Open pecan and other forests of Lower Sonoran zone near Monterey, Nuevo Leon, extending up to oak and pine forests of Transition zone near Victoria and Miquihuana, Tamaulipas, Mexico (alt., 2,000–8,500 ft.).

Characters.—Upper parts nearly uniform grayish brown or yellowish brown, much as in *Sciurus carolinensis*; feet gray; under parts white. Pelage on back soft and rather dense; tail rather full. Teats: *p.* $\frac{1}{1}$, *a.* $\frac{2}{2}$, *i.* $\frac{1}{1}$.

Color.—Winter pelage: Entire upper parts yellowish brown, finely grizzled with gray and black, usually darker along back and grayer along sides; top of head similar, but usually a little darker; eye with distinct ring of dingy whitish shaded with buff on outer border; sides of head grizzled dusky gray, often suffused with yellowish brown; ears and basal patch brownish gray; fore feet and outside of fore legs whitish gray, frequently more or less washed with buffy; hind feet whitish gray, usually with a spot of dark buffy on middle of upper surface; outside of thighs like flanks, but often with a browner shade near feet; under parts white; color of upper and lower parts usually separated by a narrow line of pale grayish; base of tail all around like back; tail above black, heavily washed with white, the yellowish brown or yellowish gray under

> color often showing through; below with broad median area of grizzled yellowish brown or yellowish gray, narrowly bordered with black and edged with white. Hairs of back black, with one and often two rings of gray, buffy, or buffy brown, the two colors sometimes on same hair and sometimes on distinct hairs. The pelage in summer is darker and more yellowish brown than in winter, due to absence of most of the gray or white tips to hairs.
>
> *Measurements.*—Average of five adults from vicinity of type locality: Total length, 471; tail vertebræ, 217; hind foot, 60.6. Average of five adults from mountains near Miquihuana, Tamaulipas: Total length, 465; tail vertebræ, 230.4; hind foot, 65.8.
>
> *Cranial characters.*—Premolars $\frac{1}{1}$. Skulls of *S. alleni* are only distinguishable from those of *S. oculatus* by their smaller size. Five adult skulls from region of type locality average: Basilar length, 50.4; palatal length, 26.3; interorbital breadth, 18.4; zygomatic breadth, 33.7; length of upper molar series, 10.5. Five adult skulls from near Miquihuana average: Basal length, 50; palatal length, 25.6; interorbital breadth, 18.1; zygomatic breadth, 33.7; length of upper molar series, 10.3.
>
> *General notes.* *Sciurus alleni* bears a close superficial resemblance to *S. carolinensis* of Texas, but has only a single premolar. From *S. o toluca* it differs mainly in smaller size, grayer feet, and whiter belly. The type of this species came from near Monterey, Nuevo Leon. By a slip of the pen in the original description the type locality was given as Monterey, Tamaulipas. Baird called attention to this squirrel in 1857, under the name "*Sciurus carolinensis? ?*" and gave the essential characters which separate it from *S. carolinensis*. Subsequent authors have referred it to the same species, or to *S. arizonensis*, but a series in the collection of the biological survey shows that it is a well-defined species most nearly related to *S. oculatus*. Neither *S. carolinensis* nor any close relative of that species occurs in Mexico.
>
> *Specimens examined.*—Twenty-two: from Monterey, Linares, Rio de San Juan, and San Pedro mines, Nuevo Leon; near Victoria and Miquihuana, Tamaulipas. (Proc. Wash. Acad. Sci., I, 1899, p. 91.)

Among my old notes I find the following:

> It is not improbable that another species of *Sciurus* inhabits the Mexican line in the Texan region. Under the head of "*Sciurus arizonensis* Coues," Dr. J. A. Allen mentions[a] the receipt of a squirrel from Texas which "in all features of coloration resembles a common phase of the southern gray squirrel (*Sciurus carolinensis*), the species that would be naturally expected to occur in Bee County, but the skull lacks all trace of the small premolar almost invariably present in this species." He also mentions a similar specimen from the San Pedro mines, Nuevo Leon, Mexico, collected by Mr. J. M. Priour.

I have not seen the specimen from Texas, but the one from the San Pedro mines, Nuevo Leon, is certainly the present species.

SCIURUS APACHE Allen.

APACHE SQUIRREL.

Sciurus griseoflavus THOMAS, Proc. Zool. Soc., London, 1882, p. 372 (not *S. griseoflavus* Gray, 1867).

Sciurus niger ludovicianus, THOMAS, Proc. Zool. Soc., London, 1890, p. 73, footnote.

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[a] Bull. Am. Mus. Nat. Hist., III, 1891, p. 222.

Sciurus apache ALLEN, Bull. Am. Mus. Nat. Hist., V, p. 29, March 16, 1893 (original description).—NELSON, Proc. Washington Acad. Sci., I, p. 91, May 9, 1899 (Revision of the Squirrels of Mexico and Central America).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 36 (Syst. Results Study N. Am. Mam., to close of 1900).—ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 58 (Synop. Mam. N. Am.); IV, Pt. 1, 1904, p. 110 (Mam. Mid. Am.).

Type-locality.—This species is based on two skins and skull taken in northern Chihuahua by the Lumholtz Expedition. (Type, skin and skull, in the American Museum of Natural History.)

Geographical range.—Forested areas in the Elevated Central Tract, between the Colorado Plateau and the Plateau of Mexico, in the Transition zone.

Description.—This splendid squirrel has the general appearance of a fox squirrel, and like it lacks the front upper premolar. Instead of a small, pallid animal, like *Sciurus rufiventer texianus*, it is of about the size of typical *Sciurus rufiventer* and a strongly-colored form. In winter there is a broad band of black extending from the crown to the root of the tail; this is seasonal, however, and disappears with the incoming of the post-breeding pelage. The sides of the head and body are yellowish gray mixed with black. Orbital ring, feet, and under surface of body ochraceous. Ears rusty drab, ochraceous around the meatus. Tail with all the hairs ochraceous at base; those of the median area below ochraceous throughout; those above ochraceous at extreme base, then black almost to the extremity, which is yellowish white, and those of the sides ochraceous at base, pale yellowish at end, and black in the middle, the three bands being of approximately equal width. The naked soles of the feet are dark purplish. Iris very dark brown.

The summer or post-breeding pelage of this squirrel is quite different from the winter pelage described above. There is no black dorsal area, and the animal more closely resembles *Sciurus rufiventer*. When this coat is new the black central area of the upper side of the tail is obscured by ochraceous tips to the hairs, and the pelage of the upper surface of the body, though with much black on the hairs, is sufficiently annulated with fulvous and pointed with hoary tips to produce a grizzled effect.

Seasonal changes.—Three adult males taken on the San Luis Mountains, July 11, 12, and 13, 1892, were in worn winter pelage; but this was being replaced to a greater or less extent, on both upper and lower surface, by the pepper-and-salt summer coat. An adult female[a] (No. $\frac{20548}{35715}$, U.S.N.M.), taken July 11, 1892, with the males just mentioned, had almost completely changed to the summer pelage, except on the thighs and tail. An adult female (No. 58904,

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[a] Mammæ, 4 pairs (P. $\frac{1}{1}$, A. $\frac{2}{2}$, I. $\frac{1}{1}$).

U.S.N.M.), killed August 31, 1893, had completed the post-breeding coat. An immature female (No. 58901 U.S.N.M.), September 7, 1893, is in complete summer pelage and of a brighter orange-buff than any other in the series. In this specimen the permanent premolar is just replacing its predecessor and the squirrel is two-thirds grown. The three remaining specimens (adults; September 5 to 29, 1893) illustrate the autumnal change.

Measurements (average of 8 adult specimens from San Luis Mountains, near Monument No. 65).—Length, 554 mm.; tail to end of vertebræ, 279; tail to end of hairs, 359; expanse of tail hairs, 160; ear from crown, 24; ear from notch, 33; hind foot, 77.

Cranial characters.—Skull (fig. 43) similar to that typical of *Sciurus rufiventer*, but relatively broad (66 by 37 mm. in *S. rufiventer* against 65 by 37 in *S. apache*). It is low, flattened superiorly, with the nasals very flat; rostrum rather high; audital bullæ much larger than in *S. rufiventer;* incisive foramen and interpterygoid fossa long, as in the fox squirrel group.

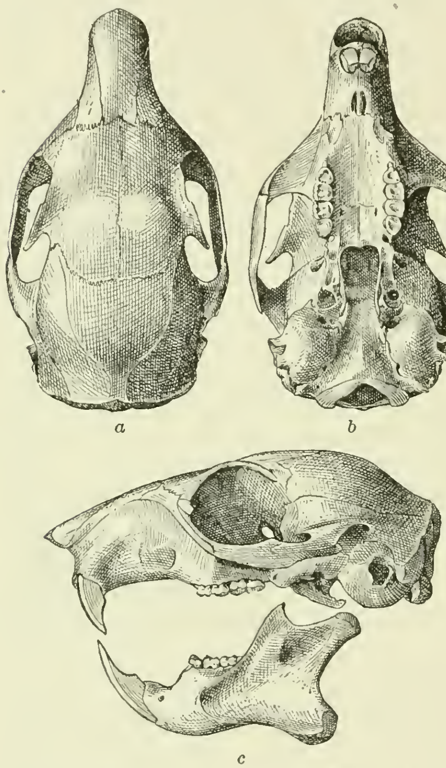

Fig. 43.—Sciurus apache. San Luis Mountains, near Monument No. 65. (Cat. No. 35692, U.S.N.M.) *a*, Dorsal view; *b*, vental view; *c*, lateral view.

Habits and local distribution.—Dr. A. K. Fisher collected a specimen of the Apache squirrel in the Chiricahua Mountains, southeastern Arizona. I have only seen it in the San Luis Mountains, in the vicinity of Monument No. 65, where it ranged from 1,700 to 2,100 meters in altitude. Nests were seen in the oak zone from 1,700 to 1,800 meters. It was not observed at the summit. Its favorite food appeared to be the acorn of *Quercus hypoleuca*, and most of the nests were placed in trees of that species. A female shot in Turkey Canyon, San Luis Mountains, Chihuahua, Mexico, July 11, 1892, contained 3 fetuses, whose envelopes measured 3½ inches in greatest diameter. Its habits reminded me much of those of the fox squirrel.

Measurements of 9 specimens of Sciurus apache.

Museum numbers.		Collector's number.	Sex and age.	Locality.	Date.	Length.	Tail to end of vertebræ.	Length of hind foot.	Ear from crown.
Skin.	Skull.								
					1892.	*mm.*	*mm.*	*mm.*	*mm.*
20551	35690	2009	♂ ad.	San Luis Mountains near Monument No. 65.	July 13	540	260	79	23
20550	35692	2006	♂ ad.	.....do...........................	July 11	540	270	75	22
20548	35715	2005	♀ ad.	.....do...........................	....do...	575	295	75	23
20549	35693	2007	♂ ad.	.....do...........................	July 12	550	275	77	24
					1893.				
58904	58904	2478	♀ ad.	.....do...........................	Aug. 31	575	280	79	25
58901	58901	2511	♀ im.	.....do...........................	Sept. 7	540	280	75	21
58900	58900	2501	♂ ad.	.....do...........................	Sept. 5	560	285	79	25
58903	58903	2555	♂ ad.	.....do...........................	Sept. 25	515	265	78	22
58902	58902	2556	♂ ad.	.....do...........................	Sept. 29	515	280	75	22

SCIURUS ARIZONENSIS Coues.

ARIZONA GRAY SQUIRREL.

Sciurus arizonensis Coues, Amer. Nat., 1, 1867, p. 357, footnote; Proc. Acad. Nat. Sci. Phila., 1867, p. 134 (original description).—Coues and Yarrow, Wheeler Surv., V, Zool., 1876, p. 116.—Allen, Bull. U. S. Geol and Geog. Surv. Terr., IV, No. 4, 1878, p. 880; Bull. Am. Mus. Nat. Hist., V, 1893, p. 30; VII, 1895, p. 245 (Fort Apache, Arizona).—True, Proc. U. S. Nat. Mus., VII, 1885, p. 595.—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 36 (Syst. Results Study N. Am. Mam. to close of 1900).

Sciurus colliei, Allen, Monogr. N. Am. Rodentia, 1877, p. 738 (in part).

[*Sciurus*] *arizonensis*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 59, fig. 14, skull (Synop. Mam. N. Am.) 6; IV, Pt. 1, 1904, p. 109 (Mam. Mid. Am.).

Type-locality.—Fort Whipple (=Prescott), Yavapai County, Arizona. Altitude about 5,000 feet. (Type, No. $\frac{3475}{37607}$, U.S.N.M.; skin and skull in good condition.)

Description.—Color above grizzled gray, black, and white, with a broad yellowish ferruginous band from occiput to base of tail; outside of limbs and feet, gray; ears, rusty gray; under parts and inner aspect of limbs, white; tail above, black, sprinkled with white in middle, and broadly edged with white; beneath, rusty brown, broadly banded with black and broadly edged with white, the hairs mainly black on terminal third.

Cranial and dental characters.—Although the front upper premolar is wanting, the skull of this squirrel is different from that of members of the subgenus *Parasciurus*. The brain case is broad, high, and swollen, much as in *Sciurus griseus anthonyi* and *S. aberti*. The frontals are flattened, almost concave in front, but strongly bulging posteriorly. The postorbital processes are long and deflected. The interpterygoid fossa is long, as in the fox squirrel, measuring considerably more in length than the combined lengths of the three upper true molars. Incisive foramina long and narrow. Audital bullæ large. Greatest length of skull (type), 60 mm.; greatest breadth, 34. Detailed cranial measurements are given below:

Cranial measurements of 8 specimens of Sciurus arizonensis.

Museum numbers.[a]		Original number.	Sex.	Locality.	Total length.	Greatest breadth.	Height of skull.	Distance between orbits.	Nasal bones, length.	Nasal bones, width before.	Upper incisors, from front to posterior margin of palate.
Skin.	Skull.										
					mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
2325	1701	355	♂	Fossil Creek, Arizona	62	35.5	26.5	22	20.8	9	31.7
2326	1702	356	♂	.....do	64.3	35.5	27.2	21.3	22	9.5	32
2327	1703	357	♂	.....do	65	37	28.2	21	21.8	9.5	33
2328	1704	363	♂	.....do	64.4	37	27.5	21.9	22.1	9	33
2329	1705	364	♂	.....do	64	36.5	27.6	22	22	8.5	31.5
2330	1706	365	♀	.....do	61.9	34.5	26.5	21	21.5	8.4	31.2
2331	1711	394	♀	.....do	60.5	35	25.5	21	20	8.9	32
......	1712	395	♀	.....do	63	37.3	26	22	21	9.7	31.5

Museum numbers.[a]		Original number.	Sex.	Locality.	Length of upper molariform series.	Greatest width across upper molars (outside).	From posterior border of upper incisors to foramen magnum.	Antero-posterior diameter of audital bullæ.	Greatest breadth of zygoma.	Length of mandible.	Length of under molariform series.
Skin.	Skull.										
					mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
2325	1701	355	♂	Fossil Creek, Arizona.........	12	16	48	12	4.8	38.8	11.8
2326	1702	356	♂	.....do	12.3	16	49	12	4.9	38.6	12.1
2327	1703	357	♂	.....do	12.5	15.5	49	12.5	5	40	12.8
2328	1754	363	♂	.....do	12.2	15.2	49	12.6	5.2	38.5	12
2329	1705	364	♂	.....do	11.5	15	49	13	5.1	40.8	12
2330	1706	365	♀	.....do	11.7	15	47	13	4.9	39	11.9
2331	1711	394	♀	.....do	12	15.1	48	13	4.7	39	12.3
......	1712	395	♀	.....do	12.6	14.7	48.8	13	5	40	12

[a] American Museum of Natural History.

Habits and local distribution.—Each of the four squirrels inhabiting Arizona has its separate habitat, none being generally dispersed. The Mogollon chickaree is confined to the fir and spruce forests of the highest altitude; the Abert squirrel is an inhabitant of the pine belt, between 5,000 and 8,000 feet altitude; the Apache squirrel is known only from the Chiricahua Mountains; while the present species prefers the deciduous timber in the canyons and along the streams of the lower country, ranging upward into the lower pine zone about as high as does the Gila chipmunk (*Eutamias dorsalis*).

While in Arizona I came across the following letter from Dr. Elliott Coues to my friend Mr. Willard Rice, which is of interest in connection with the history of this squirrel. Doctor Coues kindly consented to its publication:

> 1726 N STREET NW.,
> WASHINGTON, D. C., *December 24, 1884.*
>
> DEAR FRIEND RICE: I am glad to hear from you and thank you for the strange squirrel, which has a stranger history. Do you remember shooting a squirrel for me at Prescott in 1865? Well, that was a species new to science, which I named *Sciurus arizonensis*, and published in 1867. From that day to this I never got another one like it, and I think only two or three specimens are known to naturalists besides these two of yours. It is a pleasant memory—these two specimens—bridging an interval of nearly twenty years.
>
> Sincerely, your friend.
>
> ELLIOTT COUES.

Since discovered by Doctor Coues in 1865, the Arizona gray squirrel has not proved to be an abundant species, material for its critical study having come to the hands of naturalists very slowly. Dr. J. A. Allen, in the Monographs of North America Rodentia (p. 738), refers this species to *Sciurus colliæi* Richardson, and notes the acquisition of two additional specimens since the single one obtained by Doctor Coues. These were collected in Arizona, by Mr. Ferdinand Bischoff, in 1871. In my earlier collections, deposited in the American Museum of Natural History, New York, were fourteen specimens, taken in the months of March, April, July, and August. Mr. E. W. Nelson writes me as follows:

> I have met Coues's *Sciurus arizonensis* only once, when, in February, 1885, I shot a specimen in the mountains just east of the headwaters of the San Francisco River in New Mexico. A couple of weeks later in the same month a man brought me a second from a tributary of the San Francisco about 10 miles below where mine was taken, and told me that it was about equally common with the other gray squirrel (*S. aberti.*)

The Arizona gray squirrel, in common with other squirrels, sometimes migrates from place to place in large numbers. Mr. Stewart Daniels, who obtained many specimens of mammals and birds for me in Arizona, resided for several years in the canyon of Fossil Creek, 25 miles southeast of Fort Verde, without seeing one of these squirrels, but during March and April, 1886, there was a sudden influx of them, and numbers were seen daily. I am indebted to Mr. Daniels for eight specimens, which he kindly sent me at the time.

In the foothills below Squaw Peak, 4 miles southwest of Fort

Verde, is a rivulet having its source in a large spring. About this place are groves of mulberry, ash, and walnut trees, which are the homes of a few of these rare squirrels. One of their nests was built in an ash tree, and closely resembled the summer nest of the eastern gray squirrel (*Sciurus carolinensis leucotis*).

On July 29, 1887, I left our camp near Bakers Butte, in company with Andrew McFarland, one of the most successful hunters in the West, and descended the rim rock of Tonto Basin with difficulty, at the head of Weber Creek, hoping to find a bear in the darksome canyon at the head of that stream. In this, however, we were disappointed, two mule deer—both of which were killed by Mr. McFarland with a single bullet—being the only game seen worthy of our lead. After descending several miles, we became separated from each other. At length I came to a little miners' cabin beside the stream, where, there being no one present, I proceeded to make myself at home, and then stretched my weary limbs across the doorway, grateful for the shade afforded by the porch in front. A pleasant breeze sprang up and set the boughs of the pine trees round about to swaying musically; the brook purled its drowsy melody, and I soon fell asleep. On awaking, much refreshed, I lay quietly enjoying the scene about me, until my eye caught some falling chips of pine cones, dropped from a pine top by a squirrel which I immediately recognized as this species by its long, dark-colored tail. With inimitable grace it would make its way to the very extremity of a branch, select and remove a cone, and then return to a branch beside the tree trunk to extract the seeds at its leisure. On investigation I found this species quite abundant along the creek, and, for the purpose of making its identification absolute, shot one. The specimen proved to be a young male of the year, already two-thirds grown. About a fortnight later I returned to Weber Creek with a shotgun, and obtained six specimens, all of which were shot in the pines. They were very shy and difficult to discover. It was only found in the vicinity of the stream, where it was less abundant than the Abert squirrel. Several were seen running on the ground, searching for something among the heaps of débris and brushwood. Its habits and actions closely resemble those of the eastern gray squirrel.

I found it in August in the deciduous timber in the canyon of Pine Creek, from the Natural Bridge to its junction with the East Fork of the Verde River. It is said to occur along streams in most parts of Tonto basin. My friend, Mr. Willard Rice, informed me of its occurrence in the region about Prescott, at certain times, since he shot the first specimen, which he gave to Doctor Coues in 1865. Mr. Edward D. Tuttle, clerk of Graham County, writing from Solomonville, Arizona, March 21, 1889, refers to the abundance of "gray squirrels" in the mountains of the Graham Range.

The Hopi Indians are apparently unacquainted with it, as they gave it the same name which they apply to the chickaree; and the Hualapai Indians did not contradistinguish it from the Abert squirrel.

With our present restricted knowledge of this species it is impossible to give its habitat with accuracy. It appears to be known only from New Mexico and Arizona.

The food of the Arizona gray squirrel comprises seeds of pine cones, acorns, walnuts, berries, and green vegetation.

Record and measurements of 15 specimens of Sciurus arizonensis.

Museum numbers.		Collector's number.	Sex and age.	Locality.	Date.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Ear from crown.
Skin.	Skull.								
					1886.	*mm.*	*mm.*	*mm.*	*mm.*
[a]2325	1701	355	♂ ad.	Fossil Creek, Yavapai County, Arizona.	Mar. 18	510	310	......	27
[a]2326	1702	356	♂ ad.	.....do	....do...	......	......	......	......
[a]2327	1703	357	♂ ad.	.....do	Mar. 19	......	......	......	......
[a]2328	1704	363	♂ ad.	.....do	Mar. 27	......	......	......	......
[a]2329	1705	364	♂ ad.	.....do	Mar. 29	......	......	......	......
[a]2330	1706	365	♀ ad.	.....do	....do...	......	......	......	......
[a]2331	1711	394	♀ ad.	.....do	Apr. 5	568	298	66	......
....	1712	395	♀ ad.	.....do	Apr. 12	......	......	......	......
					1887.				
[a]2332	1710	614	♀ juv.	Weber Creek, Tonto Basin, Arizona	July 29	478	260	74	22
[a]12177	1709	623	♂ ad.	.....do	Aug. 10	517	260	72	24
[a]2333	1708	624	♂ ad.	.....do	....do...	520	262	70	25
[a]2334	1707	625	♂ ad.	.....do	....do...	519	266	73	24
[a]2335	1713	626	♀ ad.	.....do	....do...	540	265	71	24
[a]12178	1714	627	♀ ad.	.....do	Aug. 11	522	264	72	24
....	1715	682	♀ ad.	.....do	....do...	......	......	......	......

[a] American Museum of Natural History.

SCIURUS ARIZONENSIS HUACHUCA Allen.

HUACHUCA SQUIRREL.

Sciurus arizonensis huachuca Allen, Bull. Am. Mus. Nat. Hist., VI, p. 349, Dec. 7, 1894 (Huachuca Mountains, Arizona); VII, 1895, p. 245.—Nelson, Proc. Washington Acad. Sci., I, p. 96, May 9, 1899 (Revision of the Squirrels of Mexico and Central America).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 36 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Sciurus arizonensis*] *huachuca*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 60 (Synop. Mam. N. Am.); IV, Pt. 1, 1904, p. 109 (Mam. Mid. Am.).

Type-locality.—Huachuca Mountains, southern Arizona. (Type, No. $\frac{9021}{7316}$, American Museum of Natural History, New York.)

Geographical range.—Pine and oak forests of the Transition Zone, in northeastern Sonora, Mexico, and the Huachuca Mountains, southern Arizona.

Characters.—Similar to typical *Sciurus arizonensis*, but slightly smaller, with a broad band of gray over back of neck and shoulders, separating the median grizzled yellowish or pale rusty area into a narrow patch on crown and ears, and a larger one on lumbar region and rump. Mammæ: P. $\frac{1}{1}$, A. $\frac{2}{2}$, I. $\frac{1}{1}$.

Color.—Mr. Nelson describes May specimens from the Huachuca Mountains, Arizona, as follows:

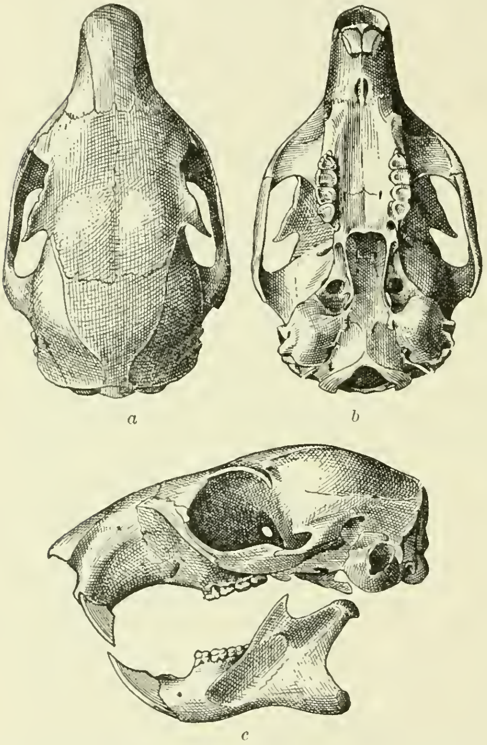

FIG. 44.—SCIURUS ARIZONENSIS HUACHUCA. HUACHUCA MOUNTAINS, ARIZONA. (Cat. No. 58966, U.S.N.M.) *a*. DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

> Upper parts, including top of nose and base of tail, pale grizzled gray with rusty yellow wash on back of crown, lumbar region, and rump; sides of neck, flanks, and outside of hind legs somewhat paler than top of shoulders; fore feet and outside of legs grizzled grayish white, sometimes pale gray; hind feet pale grizzled gray; ring around eye whitish, or slightly buffy; sides of head whitish gray, often with postocular yellowish brown suffusion; ears dingy grayish or dull yellowish, sometimes with small patch of dull gray or rusty yellow behind base; under parts white; tail above black washed with white, heaviest along border; below, broad median area grizzled rusty, dull orange yellow or yellowish brown, with heavy black border and broad white edge. Hairs on back black, with white tips and broad yellow subbasal or basal rings, or with subterminal buffy yellow rings, mixed with other hairs wholly black. Winter pelage similar to that of summer, but a little grayer on sides of body and outside of legs and feet; ears more thickly haired and dull rusty, with basal patches of same color; white on tail more distinct. (Proc. Washington Acad. Sci., I, 1899, p. 96.)

Skull.—Larger than typical *Sciurus arizonensis*, otherwise similar; differs from *S. oculatus* in having much smaller audital bullæ, larger rostrum, more inflated parietals, with occiput higher and narrower. Greatest length of skull (fig. 44), 63 mm.; greatest breadth, 37; palatal length, 27.5; interorbital breath, 20.

External measurements.—Length, 530 mm.; tail vertebræ, 250; tail to end of hairs, 330; ear from crown, 23; ear from notch, 33; head, 70; hind foot, 75.

Remarks.—It is my good fortune to have at my disposal, in addition to the thirty-five specimens of the two forms of this species collected by myself, the series belonging to the U. S. National and American museums, aggregating a much larger number than it has hitherto been possible to bring together. Careful comparisons of this material have developed the interesting fact that this species, like *Sciurus carolinensis*, undergoes a marked seasonal change of pelage, the upper surface having an almost uniformly gray coloration in summer, but with a distinct dorsal stripe of fulvous in winter. The feet appear to be grayish at all season unless stained.[a]

The subspecies *huachuca* of Allen was based on four specimens, all adult (two males and two females), from the Huachuca Mountains, Arizona, taken January 28 to February 20 by Messrs. Price and Condit. They were compared with four specimens taken at Hassayampa, near the type-locality of *Sciurus arizonensis* Coues, during the first week of January. The four Hassayampa specimens have the fulvous dorsal area continuous from the crown to the root of the tail. Doctor Allen's four specimens from the Huachuca Mountains, taken at about the same season and also in winter pelage, have much less fulvous on the dorsal surface and also a paler fulvous coloration of the under surface of the tail and a reduction in the amount of fulvous at the base of the hairs of its upper surface.

As this squirrel loves to feed upon the walnut (*Juglans rupestris*), and often eats the immature nut, its pelage during July and August is commonly stained with the juice. The white hair of the under surface becomes tawny-ochraceous wherever the walnut juice comes in contact with it, and toward the end of the season those that feed habitually on the walnut become almost uniformly of this color on the whole under surface. The naked palms and soles are likewise stained. Such individuals have much the coloration of fox squirrels, and the staining has the appearance of a natural hair coloring. In speaking of such a specimen (No. 11146, U.S.N.M., collected in Arizona), Doctor Allen observes that it "has the lower surface considerably varied with irregular patches and streaks of pale yellowish-rufous, thus showing a tendency to the acquisition of a rufous belly, so common a feature among the squirrels of Mexico and Central and South America." Comparing this specimen with those of my collection known to have the pelage stained by walnuts, the shade of color is seen to be almost precisely the same; and around the nipples where new hair is coming in, or where the young in nursing removed the walnut juice, the hair is pure white. At the first molt after the walnut-eating season is past the pelage becomes pure white. Individuals having the pelage discolored invariably have their palms stained also, while those living away from walnut trees have white bellies and clean hands. Those killed in August at the summit of the Huachuca Mountains, at an altitude of 9,000 feet, and far above the limit of walnut trees, always had white bellies, while those shot at the same season in canyons wooded with walnut almost invariably had the belly discolored.

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[a] In the eastern gray squirrel (*Sciurus carolinensis*) the corresponding seasonal difference is accentuated by the different coloration of the feet, which are rusty fulvous in summer and grayish white in winter.

Habits and local distribution.—We found this squirrel abundant in the Huachuca Mountains, but failed to discover it in any of the neighboring mountains. In the Huachucas it was found from near the lower timber line to the actual summit (2,887 meters or 9,472 feet). As remarked by Mr. Nelson, a specimen from the east side of the Santa Catalina Mountains, Arizona, between the type localities of *arizonensis* and *huachuca*, is intermediate between the two forms. For this interesting specimen I am indebted to Mr. Herbert Brown. As long ago as September 26, 1884, I learned of the presence of this squirrel in the Huachuca Mountains, from Lieut. Harry C. Benson, who found it within 2 miles of Fort Huachuca. In July and August, 1893, it appeared to be feeding chiefly upon black walnuts, and was usually found near streams.

Measurements of 20 specimens of Sciurus arizonensis huachuca.

Museum numbers.		Collector's number.	Sex and age.	Locality.	Date.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Ear from crown.
Skin.	Skull.								
					1893.	*mm.*	*mm.*	*mm.*	*mm.*
58897	58897	2418	♂ ad.	Huachuca Mountains, Arizona	July 18	512	240	70	23
58898	58898	2419	♂ ad.	do	do	532	257	71	23
58899	58899	2420	♀ ad	do	do	530	240	72	24
58905	58905	2421	♀ ad.	do	do	538	250	73	23
21387	36169	2422	♂ ad.	do	July 19	508	240	77	23
58896	58896	2423	♂ ad.	do	do	540	255	72	23
21415	36979	2424	♂ ad.	do	do	......	......	75	25
58895	58895	2438	♀ ad.	do	July 31	515	255	71	21
58847	58847	2582	♂ im.	do	Oct. 16	......	......	......	......
58861	58861	2663	— ad.	East side of Santa Catalina Mountains, Arizona.	Winter.	......	......	......	......
58957	58957	881	♀ ad.	Huachuca Mountains, Arizona	July 25	525	262	75	26
58966	58966	887	♂ ad.	do	July 29	......	......	......	......
58958	58958	906	♂ ad.	do	Aug. 3	520	266	75	23
58964	58964	917	♀ ad.	do	Aug. 8	551	274	75	24
58961	58961	918	♀ ad.	do	Aug. 10	540	263	75	23
58965	58965	919	♀ juv.	do	Aug. 11	......	......	......	......
58962	58962	937	♂ ad.	do	Aug. 14	506	254	73	22
58963	58963	938	♂ im.	do	do	496	238	70	20
58959	58959	988	♂ ad.	do	Aug. 29	512	250	72	22
58960	58960	1067	♂ ad.	do	Oct. 4	466	202	76	24

Subgenus **PARASCIURUS** Trouessart (1880).

FOX SQUIRRELS.

Parasciurus Trouessart, Le Naturaliste, II, No. 37, October, 1880, p. 292; Cat. Mam., Rodentia, p. 77, 1880 (in part).—Merriam, Proc. Biol. Soc. Washington, VII, 1892, p. 27.—Nelson, Proc. Washington Acad. Sci., I, p. 30, April 14, 1899. (Revision of the Squirrels of Mexico and Central America).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, December 27, 1901, p. 36 (Syst. Results Study N. Am. Mam. to close of 1900.)—Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 51 (Synop. Mam. N. Am.,); IV, 1904, p. 110 (Mam. Mid. Am.).

Dentition.—I. $\frac{1-1}{1-1}$; P. $\frac{1-1}{1-1}$; M. $\frac{3-3}{3-3}=20$.

Characters.—Size large; without ear-tufts; skull elongate, with a long, broad rostrum, and broad nasals; brain case long, narrow, not inflated over parietals and narrowed at occiput; interpterygoid fossa long.

SCIURUS RUFIVENTER TEXIANUS (Bachman).

TEXAS FOX SQUIRREL.

Sciurus texianus Bachman, Proc. Zool. Soc. London, 1838, p. 86 (or descr.).

Sciurus limitis Baird, Proc. Acad. Nat. Sci. Phila., VII, April, 1855, p. 331 (original description); Mam. N. Am., 1857, p. 256, pls. lxiv (animal) and lxxxi (skull); Rep. U. S. Mex. Bound. Surv., II. Pt. 2, Mam., 1859, p. 34, pls. iv (animal) and xxi (skull, 5 figures).

Sciurus niger var. *ludovicianus*, Allen, Mon. N. Am. Rodentia, 1877, pp. 724–731 (southwest Texas and Nuevo Leon, Mexico).

Sciurus niger limitis, Allen, Bull. Am. Mus. Nat. Hist., VI, 1894, p. 183; VIII, 1896, p. 67.

Sciurus ludovicianus limitis, Nelson, Proc. Washington Acad. Sci., I, p. 97, pl. i, fig. 1, May 9, 1899 (Revision of the Squirrels of Mexico and Central America); Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 36 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Sciurus ludovicianus*] *limitis* Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 53 (Synop. Mam. N. Am.).

Sciurus rufiventer texianus, Allen, Bull. Am. Mus. Nat. Hist., XVI, p. 167, July 1, 1902; Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXXI, No. 3, Aug. 27, 1903, p. 73 (Syst. Results Study N. Am. Mam. during the years 1901 and 1902).

[*Sciurus*] *rufiventer texensis*, Elliot, Field Col. Mus., Zool. Ser., IV, Pt. 1, 1904, p. 110 (Mam. Mid. Am.).

Type-locality.—Texas.

Geographical range.—Wooded areas—mostly river bottoms—of Southwestern Texas, east of the desert.

Description.—Similar to typical *Sciurus rufiventer* (fig. 46), but smaller and paler. Above yellowish gray, darkened by a very even mixture of black bands and black tips to the hairs. Sides of head, ears, feet, inner surface of limbs, and all of under surface of body orange-buff. Tail grizzled above, in the median area, with broad, lateral, subterminal bands of black and broad yellowish white tips to the hairs; under side of tail tricolored, orange-buff mesially, this bordered successively by black and yellowish white. The naked under surfaces of the feet are purplish black. Length, 475 mm.; tail to end of vertebræ, 225; tail to end of hairs, 300; ear from crown, 18; ear from notch, 30; head, 67; hind foot, 66.

Cranial characters.—This species has but one premolar on each side, above. Skull in *texianus* (fig. 45) low, with a weak rostrum; superior profile flattened in the frontal region, sharply declining posteriorly; postorbital processes of medium length and sharply deflected; audital bullæ, small; incisive foramen, long and narrow; interpterygoid fossa, long, nearly equaling the length of the upper lateral tooth-row. Greatest length of skull, 61 mm.; greatest breadth, 35.

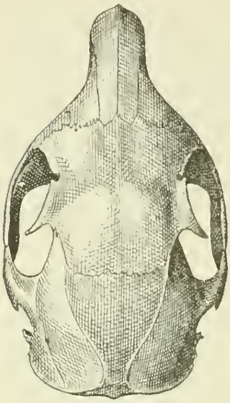

Fig. 45.—Sciurus rufiventer texianus. Dorsal view of skull. Fort Clark, Texas. (Cat. No. 12710, Amer. Mus. Nat. Hist.)

Remarks.—The color of the under surface fades with wear and exposure until it becomes nearly white, and its intensity is also subject to some individual variation. On the whole, the form is remarkably uniform. No black individuals were seen or heard of, though the fox squirrel of northeastern Texas is frequently melanistic. Dr. J. A. Allen[a] mentions a specimen from Rockport, Aransas County, Texas, "not appreciably different from specimens from the type locality (San Pedro or Devils River) of Baird's *Sciurus limitis* (=*texianus*), recently received from Dr. E. A. Mearns."

An adult female (Cat. No. 63048, U.S.N.M.) from Kickapoo Springs, Mason County, Texas, has five pairs of mammæ.

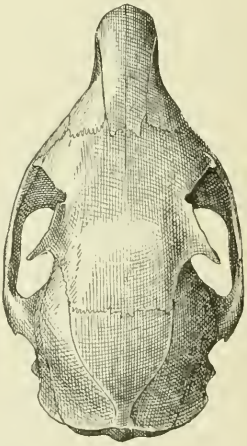

Fig. 46.—Sciurus rufiventer. Dorsal view of skull. West Northfield, Illinois. (Cat. No. 1879, U.S.N.M.)

Habits and local distribution.—On January 31, 1892, I noted a fine fox squirrel, seen in a bit of woods along the railroad between the southern border of Indian Territory and Fort Worth, Texas. I afterwards found it abundant in pecan woods along most of the streams in the region around Fork Clark, Kinney County, Texas. Pecan nuts and acorns were its principal food.

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[a] Bull. Am. Mus. Nat. Hist., VI, 1894, p. 183.

Record and measurements of 21 specimens of Sciurus rufiventer texianus.

Museum numbers.		Collector's number.	Sex and age.	Locality.	Date.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Ear from crown.
Skin.	Skull.								
					1892.	*mm.*	*mm.*	*mm.*	*mm.*
[a]12704	10997	2171	♂ im.	Fort Clark, Kinney County, Texas.	Dec. 23	490	245	68	21
					1893.				
63046	63046	2230	♂	.....do	Jan. 17	445	210	63	20
[a]12710	....	2245	— ad.	.....do	Jan. 29	......	......	......	......
63047	....	2291	— ad.	.....do	Feb. 11	......	......	......	......
[a]12707	11000	2294	♂ ad.	Kickapoo Springs, Mason County, Texas.	Feb. 15	495	240	65	18
63048	63048	2295	♀ ad.	.....do	....do...	475	215	64	17
63049	63049	2296	♂ ad.	.....do	....do...	490	235	65	18
[a]12709	....	2308	♂ ad.	Fort Clark, Kinney County, Texas.	Mar. 10	475	228	65	19
[a]12708	....	2318	♂ juv.	.....do	Apr. 8	......	......	......	......
63050	63050	2319	♀	.....do	Apr. 9	......	......	......	......
[a]12710	....	2320	♀ ad.	.....do	Apr. 14	503	250	67	20
63051	63051	2327	♀ ad.	.....do	Apr. 24	490	237	65	19
63052	63052	2328	♂ juv.	.....do	....do...	410	212	......	......
[a]5646	4637	2330	♀ ad.	.....do	Apr. 26	470	220	63	21
[a]12703	10996	2333	♂ ad.	.....do	May 22	485	233	63	20
63054	63051	2334	[b]♂ ad.	.....do	....do...	......	......	64	18
[a]12706	10999	2335	♂ ad.	.....do	....do...	485	230	67	22
63053	63053	2336	♂ juv.	.....do	....do...	430	225	......	......
[a]12705	10998	2337	♂ juv.	.....do	....do...	400	190	......	......
					1897.				
84629	84629	4271	♀ juv.	.....do	Dec. 4	487	240	68	......
					1898.				
84630	84630	[c]42	♂ ad.	.....do	May 14	475	225	61	19

[a] American Museum of Natural History. [b] Head and body, 275. [c] Collection of Louis di Z. Mearns.

Genus EUTAMIAS Trouessart (1880).

Eutamias TROUESSART, Catalogue des Mammiferes, Vivants et Fossiles, Rongeurs, 86, 1880 (new subgenus).—MERRIAM, Proc. Biol. Soc. Wash., XI, July 1, 1897, p. 189 (adopted as a full genus).

Dentition.—I. $\frac{1-1}{1-1}$; P. $\frac{2-2}{1-1}$; M. $\frac{3-3}{3-3} = 22$.

Type.—*Sciurus striatus asiaticus* Gmelin.

I have followed Doctor Merriam[a] in according generic value to the subgenus *Eutamias* of *Tamias*, to which Trouessart assigned the character "premol. 2/1." The type of *Eutamias* (fixed by Dr. J. A. Allen[b]) is *Tamias asiaticus* (Gmelin). As stated by Doctor

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[a] Proc. Biol. Soc. Wash., XI, p. 189.

[b] Proc. Linnæan Soc. New York, July, 1894, p. 26.

Merriam, the western 4-striped chipmunks of the genus *Eutamias* appear to be an offshoot from the subgenus *Ammospermophilus* of the genus *Citellus;* while the restricted *Tamias* appears to have been derived from *Ictidomys*.

KEY TO THREE SPECIES OF THE GENUS EUTAMIAS.

a. With five well-defined black dorsal stripes, separating four light ones. *Eutamias cinereicollis* (p. 284).

aa. Dorsal stripes obsolete or obscure.

  b. Black restricted to the middle dorsal stripe. *Eutamias dorsalis* (p. 288).

  bb. Black not restricted to the middle dorsal stripe. *Eutamias merriami* (p. 295).

EUTAMIAS CINEREICOLLIS (Allen).[a]

ARIZONA CHIPMUNK.

Tamias cinereicollis ALLEN, Bull. Am. Mus. Nat. Hist., III, p. 94, June, 1890 (original description); VII, 1895, p. 243.

Eutamias cinereicollis, MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 40 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Tamias*] *cinereicollis*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 75 (Synop. Mam. N. Am.).

Yŭng-yī-ŭh of the Hopi Indians of northeastern Arizona.

Type-locality.—San Francisco Mountain, Arizona. (Type, skin and skull, No. $\frac{17597}{24533}$, U. S. National Museum, Biological Survey Collection.)

Geographical range.—Boreal zone of mountains of the Colorado Plateau, in northeastern Arizona.

Description.—Size medium; pelage full and soft; ears medium size; dorsal surface with five plainly defined dark stripes and four light ones of about equal breadth. The original description, by Dr. J. A. Allen, based in part on our collection, reads as follows:

> *Autumnal pelage* (August and September).—General color above gray; sides between shoulders and hips yellowish brown; below grayish white; nape, sides

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[a] Mr. Vernon Bailey has described the following subspecies:

Eutamias cinereicollis canipes BAILEY, Proc. Biol. Soc. Washington, XV, p. 117, June 2, 1902.

Type-locality.—Gaudalupe Mountains, El Paso County, Texas. Altitude 7,000 feet. Type, Cat. No. 109229, U.S.N.M.

General characters.—Similar to *cinereicollis* in fresh postbreeding pelage, but grayer throughout, with paler and duller ochraceous on sides; tips of the long hairs on rump and upper surface of tail white instead of yellowish; feet clear gray without a tinge of yellowish; black dorsal stripe reaching forward to between ears.

Measurements.—Type: Total length 230 mm.; tail vertebræ 104; hind foot 35. *Skull* of type: Basal length 30; nasals 11; zygomatic breadth 19.3; mastoid breadth 15.8; alveolar length of upper molar series 5.8. (Proc. Biol. Soc., Wash., XV, p. 117.)

of neck, and cheeks (below malar stripe) gray, this color extending back to posterior border of scapular region, but there more blackish, and sometimes with a faint tinge of brownish suffusion. Thighs and buttocks very faintly tinged with pale yellowish brown. Dark dorsal stripes broad, deep black, edged with deep chestnut brown, the outer one on each side narrower, shorter, and less black, but sharply defined and strongly marked. Inner pair of light dorsal stripes clear whitish gray; outer pair broader and clear white. Light facial stripes rather clear white; the dark ones very broad, dull rusty brown, the ocular stripe alone much mixed with black, generally distinctly black immediately before and behind the eye. Ears externally with the central area blackish, the anterior border rusty, and the posterior broadly edged with grayish white; inner surface pale rusty. Light patch behind the ear light gray, scarcely lighter than the surrounding pelage, and hence not conspicuous. Tail above blackish, the hairs ochraceous at base and tipped broadly with buff; below broad central area orange rufous, bounded by a very narrow line of black, fringed with buff.

Breeding pelage (May–July).—Pelage softer and fuller (comparing especially May and August specimens); colors all dull and bleached, the tints of gray, black, and white, all less pure and clear, and the sides only faintly washed with pale yellowish brown, varying in different specimens to pale buff, sometimes not appreciably different from the pale dull yellowish gray of the general color of the dorsal surface.

Young.—Half-grown young are similar in color to adults in August and September, but the pelage is thinner and more silky, with the unmistakable look of juvenility. (Bull. Am. Mus. Nat. Hist., III, p. 94.)

Measurements.—Average of three adult males: Length, 223 mm.; tail to end of vertebræ, 95; tail to end of hairs, 118; hind foot, 34.3; ear from crown, 15.1; ear from notch, 20.3; head, 38.3; from tip of nose to eye, 16.3; nose to ear, 30. Average of ten adult females: Length, 225 mm.; tail to end of vertebræ, 99; tail to end of hairs, 125; hind foot, 34.1; ear above crown, 16; ear above notch, 20.1; head, 39.5; nose to eye, 15.8; nose to ear, 30.6. Skull, 37.3 by 20.7. Mammæ, four pairs.

Cranial and dental characters.—The skull closely resembles that of *Eutamias dorsalis*, but is shorter, the brain case being shorter and relatively broader, with rostrum slightly shorter and more depressed. The nasals are broad like those of *dorsalis;* incisors narrower.

Life history.—The Arizona chipmunk is of strictly alpine distribution. Its habitat is restricted to the evergreen forests, from an altitude of about 6,500 feet nearly up to timber line (11,468 feet). Its lowest range barely touches the upper limit of that of the Gila chipmunk (*Eutamias dorsalis*). It does not descend to the lower limit of the pine belt, and is most abundant in the fir and spruce forests, at an elevation of from 7,000 to 11,000 feet. The Gila chipmunk, on the other hand, finds its upper limit in the pine belt, which it penetrates to the altitude of 6,500 feet.

As might be predicted, the Arizona chipmunk descends to the lowest level along the borders of the largest areas of its habitat, as in the San Francisco Forest and Mogollon Mountains. There are many smaller areas which, from their altitude and vegetation, would afford it a congenial home, but which are surrounded by barren, inhospitable plains, that seem never to have been crossed by it. Other animals are restricted by the same causes. The forested area lying south of the Great Colorado River, in the vicinity of Pine Spring, having an altitude of 6,580 feet, affords a striking example of this sort. The vast gorge of the Colorado arches around this tract on the north, and deep canyons and broad desert plains shut it off from other forested regions on all other sides. Therefore this region, although offering every attraction in the matters of food, shelter, and climate for the alpine mammals, is actually inhabited by none of them, except the Holzner cottontail (*Lepus floridanus holzneri*). No such barriers obstruct the passage of birds; and we find the usual alpine species in this region, not excepting the Mexican turkey, whose limited powers of flight might be expected to exclude it.

In October, 1884, I found this chipmunk abundant along the crest of the Mogollon Mountains, from Bakers Butte, 35 miles east of Fort Verde, nearly to Fort Apache. At that season they were actively engaged in harvesting their winter supplies, in which employment they ascended the tallest trees. At the lower altitudes they were gathering acorns and storing them in large quantities in the ground or in hollow logs. The evergreens of higher altitudes also supplied them with food. Throughout this region it is quite common for them to emerge from beneath the deep snow in winter, and run about during the warm part of the day, but during stormy or severely cold periods they do not venture forth.

In May and June, 1887, I found it at the Star Route wagon pass, on the summit of the Mogollon Mountains, near Stonemans Lake, and thence, at the highest points, to the San Francisco Mountain. On Humphreys Peak it was found above 11,000 feet, inhabiting a dense growth of conifers. It was abundant in the San Francisco Forest, south of Flagstaff, where it probably reaches its lowest point of residence, by following the continuity of the pine forest down a gradual descent. Its evident fondness for acorns attracts it to the oak groves, which are common along the lower, rocky ridges of this elevated region.

In July and August, 1887, I was encamped with a cavalry command at Fern Spring, near Bakers Butte, in the Mogollon Mountains, about 40 miles east of Fort Verde. The locality was swampy ground having somewhat rocky sides. Here squirrels were abundant on our arrival, but by the time we had been in camp a fortnight there was an influx of the smaller species from all the surrounding country, attracted by the refuse from the horses' forage and the soldiers' rations. The Say ground squirrel (*Callospermophilus lateralis*) was the most abundant, but there was quite an army of Arizona chipmunks. They pillaged our tents and mess outfit, and even climbed into the nose bags for the horses' grain, frightening some of the animals into breaking their halters.

Their homes are made in burrows in old logs and in the ground beneath stones, logs, and roots of trees. The young, three to five in number, are brought forth in nests of dry grass and similar material, placed at the end of their burrows. The period of bearing varies somewhat according to altitude, but is well covered by the months of June and July. In the early part of June they were observed carrying immense loads of dry grass into their burrows, in the San Francisco Forest; and very young ones were running about in great numbers in the vicinity of Bakers Butte by the middle of July.

During the summer the Arizona chipmunk feeds quite extensively upon green herbage and the seeds of small plants, chiefly legumes; but, like most squirrels, it is fond of an occasional change from vegetable to animal diet. At Fern Spring they entered our kitchen tent and devoured our bacon; and I soon discovered in fat salt pork a bait so tempting that it never failed to allure them into a trap.

So little attention is at present paid to agriculture in the region occupied by this squirrel that its interests have not thus far been materially affected; and it is such a clever, pleasant little mammal that its petty pilferings about the cabins and the damage to cereal and other products, which may be expected from it in the future, ought to be forgiven.

The voice of this chipmunk resembles somewhat that of the common eastern chipmunk (*Tamias striatus*). It chippers in the same excited way when startled, and chirrups and clucks as it watches you from the top of its favorite log.

Mr. Edward D. Tuttle, clerk of Graham County, writing from Solomonville, Arizona, March 21, 1889, speaks of the abundance of chipmunks in the mountains of the Graham Range, which may have been the present species, as *E. dorsalis* would scarcely be found there.

Measurements of 13 specimens of Eutamias cinereicollis.

Museum numbers.[a]		Collector's number.	Locality.	Date.	Sex and age.	Altitude, feet.	Length.	Tail to end of vertebræ.	Length of hindfoot.	Ear from crown.
Skin.	Skull.									
				1884.			*mm.*	*mm.*	*mm.*	*mm.*
12208	In skin.	134	Bakers Butte, Arizona......	Oct. 4	♂ ad.	7,600	236	96	34	11
				1887.						
2216	1393	515	Summit of wagon pass, Mogollon Mountains, Arizona (on the old "Star route").	May 25	♀ ad.	8,000	225	94	34	15.5
2217	1394	546	.....do........................	May 26	♀ ad.	8,000	.....	.....	34	16
2218	In skin.	547	.....do........................	....do...	♀ ad.	8,000	224	97	34	15
2219	In skin.	548	.....do........................	....do...	♀ ad.	8,000	230	100	35	15
2220	1395	550	.....do........................	May 27	♂ ad.	8,000	210	94	35	15.3
2221	In skin.	552	.....do........................	....do...	♀ ad.	8,000	226	97	35	16
2222	1396	553	.....do........................	....do...	♂ ad.	8,000	.....	.....	34	16
......	1397	571	Near Flagstaff, Arizona.....	June 2	♀ ad.	7,000	229	100	35	15.5
2223	In skin.	580	San Francisco Mountain, Arizona.	June 6	♀ ad.	9,750	226	104	34	14
2224	1398	586	.....do........................	June 11	♀ ad.	10,250	232	102	33	......
......	1399	587	.....do........................	....do...	♀ ad.	10,250	217	101	34	......
2225	In skin.	595	Near San Francisco Mountain, Arizona.	June 17	♀ ad.	7,200	216	96	33	15

[a] American Museum of Natural History.

EUTAMIAS DORSALIS (Baird).

GILA CHIPMUNK.

Tamias dorsalis BAIRD, Proc. Acad. Nat. Sci. Phila., VII, 1855, p. 332 (original description); Mam. N. Am., 1857, p. 300, pl. XLVI; Rep. U. S. and Mex. Bound. Surv., II, Pt. 2, Mam., 1859, p. 37—GRAY, Ann. and Mag. Nat. Hist., 3d ser., XX, 1867, p. 436.—COUES, Amer. Nat., 1, 1867, p. 358; Proc. Acad. Nat. Sci. Phila., 1867, p. 134.—ALLEN, Bull. Am. Mus. Nat. Hist., III, 1890, p. 68; VII, 1895, p. 241.

Tamias quadrivittatus var. *dorsalis*, ALLEN, Proc. Bost. Soc. Nat. Hist., XVI, 1874, p. 290.

Tamias quadrivittatus dorsalis, COUES and YARROW, Wheeler Surv., V, Zool., 1876, p. 119.

Tamias asiaticus var. *dorsalis*, ALLEN, Monogr. N. Am. Rodentia, 1877, p. 794.

Tamias quadrivittatus pallidus COUES and YARROW, Wheeler Surv., V, Zool., 1876, p. 118.

Tamias asiaticus dorsalis, TRUE, Proc. U. S. Nat. Mus., VII, 1885, p. 593.

E[*utamias*] *dorsalis*, MERRIAM, Proc. Biol. Soc. Washington, XI, p. 210, July 1, 1897.

Eutamias dorsalis, MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 41 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Tamias*] *dorsalis*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 68, fig. 16 (Synop. Mam. N. Am.); IV, 1904, p. 134 (Mam. Mid. Am.).

Yŭng-yĭ-ŭh of the Hopi Indians of northwestern Arizona.

Type-locality—Fort Webster, Copper Mines of the Mimbres, Grant County, New Mexico, lat. 32° 47′, long. 108° 4′. (Type, skin with fragment of skull, No. 3151, U. S. National Museum.)

Geographical range.—Upper Sonoran to lower edge of Transition Zone of the Elevated Tract.

Description.—Size medium; ears high and pointed; tail long, and rather bushy; pelage short, but silky and dense. Coloration pallid, all but the median dorsal stripe being obsolete. In post-breeding pelage the color above is whitish gray, finely mixed with blackish and vinaceous; dorsal stripes faintly outlined; sides, and anterior portion of limbs, yellowish brown; ventral surface soiled white, the fur plumbeous at base. Side of head, with three dark and two white longitudinal stripes, the middle dark one involving the eye. Post-auricular patch large and white. Ear whitish, with anterior border rusty brownish, this pattern being reversed on its inner surface. Tail broad and bushy, iron-gray above, and longitudinally striped below, where the central area is orange-rufous, bordered on each side, successively, with buff, black, and gray, giving a 7-striped pattern. Hands soiled white; feet buff. Mammæ, 4 pairs.

The winter pelage is, of course, grayer, the upper surface lacking the vinaceous tint, the subterminal zone of the underfur being narrower, paler, and more yellowish.

Measurements.—Average of ten adult males: Length, 231 mm.; tail to end of vertebræ, 103; tail to end of hairs, 131; hind foot, 34.8; ear from crown, 15.9; ear from notch, 21.6; head, 40.3; distance from nose to eye, 16; nose to ear, 32. Average of fifteen adult females: Length, 238 mm.; tail to end of vertebræ, 104; tail to end of hairs, 134; hind foot, 34.6; ear from crown, 16.2; ear from notch, 21.2; head, 40.6; distance from nose to eye, 16.2; nose to ear, 32.3. Skull, 39 by 21.

Skull and teeth.—Skull (fig. 47) similar to that of *Eutamias cinereicollis*, but with braincase longer and lower, and the skull narrower anteriorly; incisors broader.

Life history.—The Gila chipmunk, as its name implies, is an inhabitant of the Gila Basin; but its range is not restricted thereto, and may also be found to cover a considerable portion of the Colorado and Yaqui River basins. Its preference seems to be for broken, rocky country, where there is timber; yet it inhabits long reaches of barren canyons, entirely destitute of trees. It must, necessarily, be able to subsist on a great variety of food, else it could not exist under such diverse conditions. Although quite abundant, in suitable localities, in the pine zone, it is more characteristic of the jagged canyons, rocky basins, and precipitous slopes bordering the mesas, which constitute such marked topographical features of this region, and which afford it a wider field for the development and exhibition of its scansorial powers.

I found it along the line of the Colorado from Peach Springs and Diamond Creek to near the mouth of Cataract Creek. It was abundant in the deep canyon of the latter stream, where I obtained specimens at the Havasupai Indian settlement, at the altitude of 3,090 feet, and found it thence for a distance of 30 miles up the canyon.

In the pine region around Whipple Barracks it is exceedingly abundant. I found it at the highest points in that neighborhood, where the Arizona mountain chipmunk (*Eutamias cinereicollis*) does not occur. Thence it follows the course of the streams and canyons, always avoiding the smooth country, into the Agua Fria Valley on one side and the Verde on the other. I traced it down the Agua Fria and its branches to a point below New River and down the Verde River nearly to Salt River and the Gila. It ranges along the tributaries of the Verde River well up into the foothills and along the high mesas of the Mogollon Mountains, reaching the altitude of 6,500 feet; and to the southward it ranges to the pine-clad summits of the Mazatzal Mountains. I also found it in the valleys of Salt River and the Gila, and among the rocky foothills bordering the Santa Cruz and Rio San Pedro, in southern Arizona. During a brief visit I failed to find it in the foothills of the Chiricahua Mountains, but it probably ranges through those mountains as it enters the Mexican State of Sonora. We were unable to find it in the San Jose or Huachuca Mountains or in the ranges to the westward.

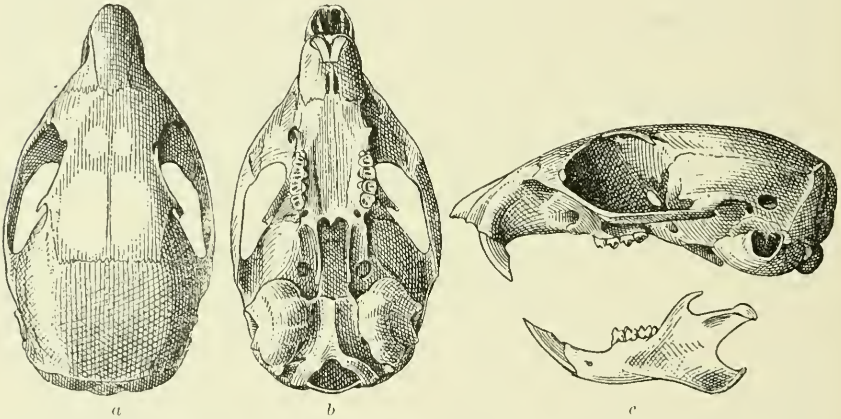

FIG. 17.—EUTAMIAS DORSALIS. (Cat. No. 37038, U. S. N. M.) *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

The Gila chipmunk was originally described by Spencer F. Baird from specimens procured by J. H. Clark in the canyons of the copper mines of the Mimbres, near Fort Webster, New Mexico. Mr. H. W. Henshaw has taken it at El Moro and Dr. J. R. McKee at Fort Defiance in this Territory. To the north of the Colorado River, Dr. C. Hart Merriam obtained it at Ogden, Utah, in 1872, thus greatly extending its known range; and its future occurrence in the area lying between that point and the Arizona border may be safely predicted.

This preeminently saxicolous mammal is common in the limestone bluffs and canyons bordering the Verde River in the vicinity of the military post of Fort Verde: but I never detected it, during a residence of more than four years, in the broad river bottom. In fact, it avoids level ground, always seeking cliffs and the rockiest places.

It infests the bluff banks and side canyons of Beaver Creek, which springs from numerous sources in the Mogollon Mountains of central Arizona and empties into the Rio Verde at Fort Verde. This was the most convenient place in which to study the habits of this nimble climber, whose fleetness and boldness, displayed in scaling the perpendicular cliffs (the crevices and holes of which afford it sufficient shelter), never ceased to excite my admiration and astonishment; but its excessive shyness precluded a close acquaintance. It was next to impossible to kill one; and the few specimens taken were the result of snap shots, usually from the saddle, when both the squirrel and myself were in motion, or of tedious lying-in-wait. It runs with extraordinary swiftness, quickly placing a wall of rock between itself and an enemy, or disappearing into a crevice. It lacks the curiosity of the eastern chipmunk, and seldom ventures to exhibit itself after being frightened to cover.

It delights in the picturesque caves and ruined buildings of the cliff dwellers, in which these canyons abound. From the shelter and concealment of these ancient habitations I have been able to watch the actions of this chipmunk, whose timidity contrasts strikingly with the confiding familiarity of the Arizona chipmunk. When all is quiet and it fancies itself unobserved, one emerges from a horizontal fissure in the wall of soft limestone and utters a resounding note, followed by a chirrup and rattle, as another little fellow comes out close behind it. Then they make a rush along some previously-invisible ledge and disappear in a vertical seam, before unnoticed, as if by magic. Thence issue excited chipperings, followed by the scratching of claws upon the rock face overhead, and they are gone. Another family presently appears in another quarter, where they frolic noisily and nervously brandish the long, bushy tail, which is the crowning glory of this pretty species, figuratively speaking, for they drag and whirl it after them as they scuttle like lizards over the cliff. Again the pattering of paws and dropping of loose scales of limestone from above announce the return of the first pair. They appear with pouches distended with cedar berries gathered from one of the dwarfed trees at the summit of the cliff. If a piñon pine has chanced to obtain a foothold on a ledge, not one of its toothsome nuts will they permit to fall uneaten; but, as already remarked, its range of food is quite extensive, and few of nature's bounties are left untasted. Of its domestic affairs I was able to learn little, beyond the fact that it utilizes soft materials of whatever kinds are at hand in making its hearthstone warm and comfortable; but its precautions against the intrusion of unwelcome visitors were such that I never was able to effect an entrance to its inner sanctuaries and obtain a glimpse of the home and family, much as my curiosity was piqued.

Seen upon the dazzling walls of limestone inclosing the canyons of this region, this chipmunk often appears much smaller than it really is, perhaps because its distance is usually underestimated, on account of the distinctness with which objects are visible against the white rock. When attempting to procure specimens, I have occasionally ridden into a narrow canyon, and, leaving my horse, suddenly turned a corner and surprised the chipmunks, who, taken unawares, would attempt, in the excitement of the moment, to climb a surface that was not simply perpendicular, but actually overhanging the canyon. I fired an unsuccessful shot at one of these unfortunates, just in time to drive it to desperation. It made a frantic attempt to scale such a place, and only failed upon reaching an alcove having a strongly arched roof, in which it could no longer obtain a footing. It fell to the ground, a distance of about 40 feet, but escaped, apparently unhurt, into a rift in the base of the canyon. Hackberries, of which this chipmunk is fond, grow in these canyons. It is active throughout the winter at this altitude, as it doubtless is at the higher levels. When the country becomes more closely settled, we may expect some modification of its shy habits and some destructiveness to crops.

In the vicinity of Whipple Barracks are immense piles of coarse granite rock surrounded by openings in which are groves of forest trees. In these rock piles the Gila chipmunk finds an entirely congenial retreat, and is very abundant, although quite as shy as elsewhere. Its food consists largely of the acorns of the evergreen oak tree (*Quercus emoryi*). Tonto basin presents somewhat similar topographical features and similar vegetation. In it I found this chipmunk along Pine, Canyon, Cibicu, Carrizi, Corduroy, and Cedar creeks, feeding here also on the acorns of the evergreen oak trees, which it climbed with ease. In the foothills it frequents the smaller canyons and arroyos, bordered with evergreen scrub oaks, which supply it with food to its liking and shelter it from its enemies.

It is probable that the habitat of this species nowhere actually overlaps that of the Arizona chipmunk, although the two occasionally touch each other or are separated by an interval a few miles broad or a few hundred feet in altitude. The narrow intermediate zone is occasionally occupied by the Say chipmunk (*Callospermophilus lateralis*), which species, however, has almost the same area of distribution as the Arizona chipmunk. At Stonemans Lake, on the northwestern slope of the Mogollon range, having an altitude of 6,215 feet, this species is very numerous, finding in the rocky walls of the lake basin a satisfactory abode; but between that point and the summit of the mountain is a pine forest free from rocks quite unsuited to the present species. In traversing this forest, which rises gradually to near the summit of the range, Say's was the only chipmunk found until a certain altitude (about 6,600 feet) was reached, when the first Arizona chipmunks appeared, whereupon both species (*Callospermophilus lateralis* and *Eutamias cinereicollis*) became gradually more abundant until the top was reached. The large area of Tonto Basin is bounded on the north by a nearly vertical precipice, or "rim-rock," hundreds of feet high, whose summit marks the backbone of the Mogollon Mountains. This is the typical home of *Eutamias cinereicollis*, while the basin itself is an equally populous stronghold of the Gila chipmunk. Nowhere have I seen so palpable a line of division between two contiguous species, and I imagine that few naturalists, seated on this fence, would hesitate about the separation of these two distinct mammals, whose habitats touch each other, while each retains all of its distinctive characters.

West of the Verde Valley, a few Gila chipmunks were noted March 26, 1885, in rocky places between Antelope and Bumble Bee postoffices, in Yavapai County, Arizona; and some were seen farther south, in Black Canyon, the next day. I saw some of them near Mountain Spring, east of Tucson, Arizona, April 8, 1885. The banks of Ash Creek, Agua Fria Valley, which were wooded with scrub oak and lined by rocky bluffs, were inhabited by numbers of these chipmunks May 19, 1885.

The Gila chipmunk crosses the Mexican Boundary Line in a narrow belt, including the San Luis and Guadalupe mountains (Monuments Nos. 64 to 75). None were found east or west of this area. The absence of any species of chipmunk from the Huachuca Mountains is remarkable.

In the San Luis Mountains the young are apparently born during July. Adults caught June 24, 26, and July 20, contained, respectively, 3, 2, 8, and 7 fetuses.

On the Mexican Border the vertical range of the Gila chipmunk was noted as from 1,200 meters (in Guadalupe Canyon) to 2,498 meters (summit of San Luis Mountains, where it was fairly common). In Cajon Bonito Canyon it is abundant; some had descended as low as 1,200 meters, and were active late in September, 1893.

Measurements of 26 specimens of Eutamias dorsalis.

Museum number. Skin.	Museum number. Skull.	Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hindfoot.	Ear from crown.
				1881.		*mm*	*mm*	*mm*	*mm*
[a]2227	In skin.	95	Whipple Barracks, Arizona	Apr. 21	♀ ad.	240	95	31.0	......
[a]2248	In skin.	116	Cataract Creek, Arizona	Nov. 11	♀	219	95	30.5	16.5
				1885.					
[a]2215	1390	197	Fort Verde, Arizona	June 4	♀ ad.	226	102	31.0	17.0
[b]1348	1974	210	.....do	Sept. 17	♂ ad.	222	100	33.0	17.0
[a]12156	....	280	Cherry Creek, Yavapai County, Arizona.	Nov. 19	♀ ad.	236	104	34.0	17.0
				1887.					
[a]2226	In skin.	536	Stonemans Lake, Arizona	May 22	♀ ad.	224	101	31.0	16.0
[a]2229	1391	628	Mormon settlement, Pine Creek, Arizona.	Aug. 11	♀ ad.	225	100	31.5	17.0
[a]12157	1401	633	Fort Verde, Arizona	Aug. 30	♂ ad.	229	107	33.0	16.5
[a]2230	1392	641	Prescott, Arizona	Nov. 12	♀ ad.	237	105	35.0	17.0
[a]2231	1402	642	.....do	....do...	♀ ad.	234	98	34.0	17.0
[a]2232	In skin.	643	.....do	....do...	♂ ad.	238	106	34.0	16.5
				1892.					
20503	35708	1907	East side of San Luis Mountains, near Monument No. 63.	June 23	♀ ad.	246	106	36.0	17.0
20506	35737	1909	.....do	....do...	[c]♂ ad.	......	......	36.0	17.0
20500	35742	1910	.....do	....do...	♂ ad.	240	117	34.5	16.5
20508	35733	1912	.....do	June 24	♂ ad.	227	104	35.0	14.0
20505	35736	1913	.....do	....do...	♀ ad.	233	104	36.5	17.0
20504	35744	1914	.....do	....do...	[d]♀ ad.	......	......	35.5	15.0
20507	35718	1915	.....do	June 25	♂ ad.	232	102	36.0	15.0
20496	35734	1917	.....do	June 26	♂ ad.	230	100	34.0	14.0
20499	35735	1918	.....do	....do...	♂ ad.	225	91	36.0	15.0
20497	35731	1919	.....do	....do...	♀ ad.	230	91	33.0	14.5
20498	35716	1920	.....do	....do...	♀ ad.	250	113	37.0	15.0
20495	37038	1949	Guadalupe Canyon, near Monument No 72.	July 7	♀ ad.	243	109	35.5	15.5
20502	35745	2017	Turkey Canyon, west side of San Luis Mountains.	July 20	[e]♀ ad.	246	104	37.0	16.0
20501	35695	2019	.....do	July 21	♀ ad.	245	111	36.0	17.0
21333	35813	2029	Guadalupe Canyon, near Monument No 72	July 28	♀ ad.	247	113	35.0	16.0

[a] American Museum of Natural History.

[b] Collection of Dr C Hart Merriam

[c] Head and body 139.

[d] Contained three small fetuses Head and body, 135.

[e] Contained seven small fetuses.

EUTAMIAS MERRIAMI (Allen).

MERRIAM CHIPMUNK.

Tamias asiaticus merriami Allen, Bull. Am. Mus. Nat. Hist., II, No. 3, Oct. 21, 1889, p. 176; III, 1890, p. 84.

E[utamias] merriami, Merriam, Proc. Biol. Soc. Washington, XI, p. 191, July 1, 1897.

Eutamias merriami, Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 41 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Tamias*] *merriami*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 71 (Synop. Mam. N. Am.); IV, 1904, p. 137 (Mam. Mid. Am.).

Type-locality.—San Bernardino Mountains, southern California. (Type, No. 1157, American Museum of Natural History.)

Geographical range.—Upper Sonoran and Transition zones of mountains of southern California, and the adjacent portion of Lower California.

Description.[a]—Size large; ears high and pointed; tail long and rather bushy. Pelage rather coarse. As usual, the winter pelage is grayish, and the post-breeding pelage reddish. Spring specimens are olive-gray above, with many yellowish hairs admixed; sides yellowish fulvous. Five dark dorsal stripes are indicated, though the central one, which is practically continuous from the head to the root of the tail, is the only one that is sharply defined and black, the two outer pairs becoming obsolete and brownish. Inner pair of light stripes pale gray, mixed with yellowish; outer pair light silvery gray—almost white. Pelage of upper surface plumbeous-black at base. Post-auricular patches small and whitish. Tail above blackish, with gray tips and yellowish subterminal bands to the hairs; below, central area reddish chestnut, paler at the edges, and bordered with a broad band of black, the latter fringed with grayish white. Ventral surface white, showing grayish between the white tips of the hairs. Feet and hands, rusty yellowish gray. Ears with outer surface rusty brown anteriorly and grayish posteriorly; inner surface pale yellowish gray.

The post-breeding pelage is shorter and coarser, and has the grayish tints of the upper surface, except on rump and outer aspect of thighs, replaced by tawny-olive, russet, and cinnamon. The dorsal stripes are more clearly defined; the middle pair of lateral dark stripes is quite a little black. The sides vary in color with the individual from tawny-olive to cinnamon. As usual, the pelage of the young depends on the season of birth, those born early having the winter and those born late the summer pelage; the color and quality of the coat vary accordingly; in some the ventral surface is washed with fulvous.

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[a] Based on specimens from on or near the Mexican Line, collected by the International Boundary Commission.

A specimen (No. 61132, U.S.N.M.) taken on the hot east slope of the Coast Range Mountains, near Mountain Spring, was in complete post-breeding or summer pelage May 15, at which season those on the peaks and west slope of these mountains were still in winter pelage. Very few of those taken at Laguna, in the pine zone, June 9 to 21, were out of the winter pelage; those in summer pelage were immature, probably born the preceding year. The Mountain Spring specimen differs from all the rest in being paler and browner, with no black in the dark dorsal stripes, except in the middle of the median one, the two outer pairs being reddish brown, the outermost blending with the cinnamon of the sides.

Measurements.—Average of five adult males: Length, 247 mm.; tail to end of vertebræ, 115; tail to end of hairs, 144; hind foot, 36; ear from crown, 13. Average of fifteen adult females: Length, 254 mm; tail to end of vertebræ, 121; tail to end of hairs, 151; hind foot, 36.4; ear from crown, 15.1. Skull, 39 by 20.5. Mammæ, four pairs.

Skull.—Compared with *Eutamias cinereicollis* and *E. dorsalis*, the skull is slightly larger, relatively narrower and higher, with the rostral portion less depresed and more elongate, the nasal bones very narrow and suddenly expanded apically, and the interpterygoid fossa longer and narrower. All three species differ from the type of the genus in having the infraorbital foramen reduced to a narrow, slit-like opening instead of a large, open, rounded foramen.

Habits and local distribution.—We found the Merriam chipmunk ranging from Mountain Spring and the lower slopes of the Coast Range over the highest peaks, but not extending its range to the Pacific Ocean. The young are probably born in May and June. Fifteen adult females, taken June 7 to 21, 1894, were nursing, none being pregnant. A very young individual was taken at the summit of the Coast Range June 20, 1894. It climbs over rocks, bushes, and trees, feeding upon various seeds, fruits, and berries, but especially on acorns and pine seeds.

Record and measurements of 22 specimens of Eutamias merriami.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hindfoot.	Ear from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
61132	61132	1975	Mountain Spring, east slope of Coast Range, California.	May 15	[a] ♂ ad.	......	......	34	11
60841	60841	1380	Jacumba, San Diego County, California.	May 30	♂ ad.	238	112	35	10
61134	61134	3632	Laguna, Coast Range, San Diego County, California.	June 9	[b] ♀ ad.	244	109	36	17
61135	61135	3633	.....do	....do...	[b] ♀ ad.	260	124	37	15.5
61136	61136	3634	.....do	....do...	♀ ad.	254	126	38	15
61137	61137	3635	.....do	....do...	♂ ad.	250	120	36.5	15.5
61139	61139	3647	.....do	June 12	[b] ♀ ad.	257	125	37	13
61140	61140	3652	.....do	June 13	♀ ad.	251	121	37	13
61141	61141	3653	.....do	....do...	♀ ad.	250	122	36	16
61142	61142	3654	.....do	....do...	[b] ♀ ad.	260	123	38	16.5
61143	61143	3655	.....do	....do...	[b] ♀ ad.	257	126	37.5	15
61144	61144	3656	.....do	....do...	[b] ♀ ad.	257	125	37	13
61146	61146	3658	.....do	....do...	♀ juv.	251	120	37	13
[c]8261	63084	3660	.....do	June 14	[b] ♀ ad.	250	115	37	15
[c]8250	6593	1403	.....do	June 4	[b] ♀ ad.	239	113	36	15
60843	60843	1469	.....do	June 18	♂ ad.	252	111	38	16
[c]8252	6595	1470	.....do	....do...	♀ ad.	258	121	37.5	17
[c]8253	....	1471	.....do	....do...	♀ ad.	262	124	40	15.5
[c]8255	6597	1485	.....do	June 20	♂ ad.	247	118	36	13
61152	61152	1486	.....do	....do...	♀ juv.	......	......	......	......
[c]8256	6598	1488	.....do	June 21	♀ ad.	247	120	36	13
[c]8257	....	1489	.....do	....do...	♀ ad.	260	124	36.5	17

[a] Head and body, 130 mm. [b] Mammæ, 4 pairs. [c] American Museum of Natural History.

Genus AMMOSPERMOPHILUS Merriam (1893).[a]

Ammospermophilus MERRIAM, Proc. Biol. Soc. Washington, VII, p. 27, April 13, 1893.

Type.—*Tamias leucurus* Merriam.

Characters.—Dorsum with one longitudinal stripe on each side; external ears considerably more developed than in *Citellus citellus* (Linnæus), but less so than in *Callospermophilus;* mammæ, 5 pairs; tail, cylindrical at base, flattened and bushy on terminal two-thirds; skull similar to that of *Eutamias*, but higher and more flattened posteriorly, with relatively shorter and thicker rostrum, narrower palate, heavier dentition, and larger audital bullæ. The skull differs even more from *Citellus* in being relatively narrower, flattened above and elevated posteriorly, with audital bullæ high and compressed laterally, and in having the first premolar a much smaller, simple, peg-like tooth.

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[a] The generic name *Spermophilus*, so long in general use for the ground-squirrels or Spermophiles, has given place to the older name *Citellus*, and three of its subgenera have been raised to the rank of genera.

The ground squirrels of the United States and Mexican Boundary region may be determined by means of the following:

KEY TO GROUND-SQUIRRELS FOUND ON THE MEXICAN BOUNDARY LINE, BASED ON EXTERNAL CHARACTERS.

a. Above longitudinally striped, or spotted in longitudinal series, forming interrupted stripes.

b. Stripes continuous.

c. With one white stripe on each side.

d. Tail white below.

e. Caudal hairs with one free black band.

Ammospermophilus leucurus (p. 299)

ee. Caudal hairs with two free black bands.

Ammospermophilus leucurus interpres (p. 301)

dd. Tail iron gray below.

f. Coloration dark; length of caudal vertebræ, 80 mm.

Ammospermophilus harrisii (p. 303)

ff. Coloration pallid; length of caudal vertebræ, 95 mm.

Ammospermophilus harrisii saxicola (p. 306)

cc. With three stripes on each side, one white and two black.

g. Tail all grayish or vinaceous above.

Callospermophilus lateralis (p. 309)

gg. Tail with terminal half black above.

Callospermophilus bernardinus (p. 313)

bb. Stripes interrupted, composed of lines of spots or of stripes containing rows of spots.

h. Larger; length more than 280 mm.

i. Color olivaceous gray; tail flattened, long, and bushy.

Citellus (*Ictodomoides*) *mexicanus parvidens* (p. 328)

ii. Color soiled yellowish; tail subcylindrical, with rather short hairs.

Citellus (*Ictidomys*) *tridecemlineatus texensis* (p. 327)

hh. Smaller; length less than 280 mm.

j. Upper surface pale grayish brown.

Citellus (*Xerospermophilus*) *spilosoma annectens* (p. 332)

jj. Upper surface russet or vinaceous cinnamon.

k. Color pallid; spots small.

Citellus (*Xerospermophilus*) *spilosoma arens* (p. 331)

kk. Color dark; spots large.

Citellus (*Xerospermophilus*) *spilosoma macrospilotus* (p. 333)

aa. Above not distinctly striped or spotted in longitudinal series.

l. Form squirrel-like; ears high; tail flattened and bushy.

m. Smaller; length, 410 mm.; tail, 170; hind foot, 55. A triangular patch of silver gray above shoulder; six pairs of mammary teats.

Otospermophilus beecheyi (p. 324)

mm. Larger; length, 490 mm.; tail, 220; hind foot, 62. No triangular patch above shoulder; five pairs of mammary teats.

n. Color of mantle grayish.

Otospermophilus grammurus (p. 315)

nn. Color of mantle black.

Otospermophilus grammurus buckleyi (p. 323)

ll. Form weasel-like; ear-conch minute; tail terete.

Citellus (*Xerospermophilus*) *tereticaudus* (p 336)

AMMOSPERMOPHILUS LEUCURUS (Merriam).[a]

ANTELOPE GROUND-SQUIRREL.

Tamias leucurus Merriam, North American Fauna, No. 2, October 30, 1889, pp. 19–21 (original description).

Spermophilus leucurus, Merriam, Proc. Biol. Soc. Washington, VII, p. 27, April 13, 1892.—Elliot, Field Col. Mus., Zool. Ser., II, March, 1901, p. 86. ("*Spermophilus* (*Ammospermophilus*) *leucurus*," fig. 18, p. 85.)—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, December 27, 1901 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Citellus* (*Ammospermophilus*)] *leucurus*, Trouessart, Cat. Mam. tam viv. quam fossilium, Supl. Fasc. II, Rodentia, 1904, p. 335.—Elliot, Field Col. Mus., Zool. Ser., IV, p. 142 (Mam. Mid. Am).

Type-locality.—San Gorgonio Pass, southern California. (Type, skin and skull, No. $\frac{1108}{1660}$, collection of Dr. C. Hart Merriam.)

Geographical range.—Sonoran Zone, on the east side of the Coast Range Mountains, on the Mexican Line, and thence northeast along the Colorado River, passing into the subspecies *cinnamomeus* in the Painted Desert of northeastern Arizona, and *interpres* in New Mexico and Texas. Not found on the Mexican Border between the Rio Grande of Texas and the Coast Range Mountains of California, its range lying to the northward.

Description.—About the size of the eastern chipmunk (*Tamias striatus*). Tail short and distichous. Length, 225 mm.; tail vertebræ, 75; hind foot, 39; head, 45; skull, 40 by 22.5. Mammæ, 5 pairs. Color above finely mixed yellowish, vinaceous, and dark brown, much grizzled, grayest on the anterior half of the body, and most vinaceous on the posterior half and on the outer surface of the limbs. There is a broad, white, longitudinal stripe on each side extending from the shoulder to the rump. Orbital ring and under surfaces white. Feet yellowish white. Tail grizzled, vinaceous, and black above, white below, the lateral hairs once broadly ringed with black. Skull with the audital bullæ very large and prominent, the basi-occipital being correspondingly reduced in breadth. It is very similar to

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[a] The following subspecies occur near our limits:

AMMOSPERMOPHILUS LEUCURUS CINNAMOMEUS (Merriam).

Tamias leucurus cinnamomeus Merriam, North American Fauna, No. 3, September 11, 1890, p. 52. (Type-locality, Echo Cliffs, Painted Desert, Coconino County, Arizona.)

Spermophilus leucurus cinnamomeus, Bryant, Zoe, III, October, 1892, p. 208.

AMMOSPERMOPHILUS LEUCURUS PENINSULÆ (Allen).

Tamias leucurus peninsulæ Allen, Bull. Am. Mus. Nat. Hist., V, p. 197, Aug. 18, 1893, (Type-locality, San Telmo, Lower California, Mexico).

[*Spermophilus*] *leucurus peninsula*, Trouessart, Cat. Mam., Pt. 2, 1897, p. 434.

[*Citellus leucurus*] *peninsulæ*, Elliot, Field Col. Mus., Zool. Ser., IV, 1904, p. 143. (Mam. Mid. Am.).

Ammospermophilus harrisii (p. 303), but with the nasal bones narrower posteriorly.

Remarks.—April and May specimens, in the Coast Range Mountains, California, were mostly in winter pelage, but molting more or less into the summer pelage. The large series of young specimens, of various ages, collected at this time is instructive as showing the changes and their sequence before the adult pelage is acquired. Ten very young specimens (size of *Blarina brevicauda*), from one burrow, are rather thinly clad in a dress that resembles their parents', though with the markings intensified. The crown, rump, and outer surface of limbs are vinaceous cinnamon; upper surface of tail black with white-tipped hairs along sides and at extremity; back gray anteriorly, dusky, grizzled, vinaceous posteriorly; side stripes pure white; feet rusty white; under surfaces yellowish white, except the tail, which is pure white. Before the animal is half grown this coat fades and acquires a dull olivaceous tinge. Molting begins when the animal is half grown, commencing posteriorly and proceeding much as in the autumnal molt of adults.

Specimens from the eastern base of the Coast Range Mountains are paler than those from the notches at or across the summit of the divide.

This beautiful species had long been in collections, but overlooked and confounded with *Ammospermophilus harrisii* until described, in 1889, by Doctor Merriam, who subsequently[a] made it the type of his subgenus *Ammospermophilus*, which has since been recognized as a genus.

Habits and local distribution.—Gen. George Crook called my attention to the difference between this species and *Ammospermophilus harrisii* November 10, 1884, when we rode through 27 miles of the lower portion of Cataract Creek, in northern Arizona. We found it to be numerous in the Cataract Creek Canyon, about the Havasupai Indian village, and on November 13, 1884, saw many of them in the side canyon through which the Hualapai Indian trail led to the westward. They scurried from bush to bush, with tail erected at right angles with the body, thus showing the white pattern. My first specimen was shot on the trail leading to Vitz's crossing on the Colorado, November 16. Three antelope ground-squirrels had one burrow at the side of a small canyon and another at the top of the canyon, under a large stone, beneath which I found a large heap of yucca fruits and cones of piñon pine.

On the Mexican Boundary this species was not met with until the east base of the Coast Range Mountains was reached, when it appeared on entering the wagon pass through these mountains at the lowest water. At Mountain and Jacumba springs it was very abundant. It was last seen about 10 miles west of Jacumba Hot Springs, in rocky hills bordering a canyon near the Hayden ranch. On the plain called Jacumba Flats the antelope ground-squirrel was very numerous, living on level ground, digging its burrows under sagebrush, much as *Citellus tereticaudus* does; but in the canyon at the head of Jacumba Creek it lived in the most rugged mountain sides. When running, its tail is always carried vertically; and it continually utters a trilling call that sounded on the ear from various distances all through the days spent in camp at Mountain Spring. The large cheek-pouches of those killed were always found to contain seeds or green vegetation. Sometimes it is very shy and seldom seen, while at other times it appears in abundance and is very tame. Mr. Holzner made the following note:

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[a] Proc. Biol. Soc. Wash., VII, p. 27, April 13, 1892.

> At Mountain Spring, California, in May, 1894, 10 small young individuals of uniform size were caught from one hole. The mother was never seen; and, as the place was very near the rock house (occupied by soldiers) and my tent, she could not have passed in and out unnoticed. Did she have sufficient food in her nest, or did she forage at night?

AMMOSPERMOPHILUS LEUCURUS INTERPRES (Merriam).

EL PASO GROUND-SQUIRREL.

Tamias interpres MERRIAM, North American Fauna, No. 4, Oct. 8, 1890, p. 21 (original description).

Spermophilus interpres, BRYANT, Zoe, III, Oct., 1892, p. 208.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 51 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Spermophilus*] *interpres*, ELLIOT, Field Col. Mus., Zool. Ser., II, Mar., 1901, p. 86 (Synop. Mam. N. Am.).

[*Citellus*] *interpres*, ELLIOT, Field Col. Mus., Zool. Ser., IV, 1904, p. 143.

Type-locality.—El Paso, Texas. (Type, skin and skull, No. $\frac{18162}{25060}$, U. S. National Museum, Biological Survey Collection.)

Geographical range.—Sonoran Zone, in the Eastern Desert Tract of New Mexico and Texas.

Description.—Similar to typical *Ammospermophilus leucurus*, but darker and more strongly colored, with the head grayer. The pelage is much finer and longer. Tail bushy, the lateral hairs with two free black bands. The general size and length of tail are almost exactly the same as in typical *A. leucurus*. Specimens from New Mexico, east of the Painted Desert (the habitat of *Ammospermophilus leucurus cinnamomeus*), in the collection of the American Museum of Natural History, New York, are intermediate between typical *leucurus* and *interpres*.

Remarks.—All of our specimens were adults, taken during February and March, when they were in complete winter pelage.

As our survey proceeded westward from the initial monument near El Paso, Texas, no representative of the *Ammospermophilus leucurus* group was found until we had crossed all of the New Mexico section, and a considerable part of the Arizona section of the Boundary, when *Ammospermophilus harrisii* appeared on the western border of the Elevated Central Tract. *Ammospermophilus leucurus* was not encountered until we had crossed the Western Desert and reached the rocky base of the Coast Range Mountains in California.

Habits.—In the vicinity of El Paso these ground-squirrels were abundant, living among rocks and cliffs on both sides of the Rio Grande, in Texas and Chihuahua. They were readily taken in traps baited with cheese.

Measurements of 33 specimens of the Ammospermophilus leucurus group.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind foot.	Height of ear above crown.
Skin.	Skull.								
			Ammospermophilus leucurus.	1881.		*mm.*	*mm.*	*mm.*	*mm.*
[a]2233	In skin.	153	Grand Canyon of the Colorado, near Pine Springs, Arizona,	Nov. 16	♂ ad.	[b]231	51	36	4.5
				1894.					
60828	60828	1955	First water, at east base of Coast Range Mountains, near Mexican Boundary Line.	May 7	♀ ad.	213	65	37	4.5
61153	61153	1956	.....do	May 8	♀ im.	191	58	37	6
60829	60829	1960	.....do	May 9	♂ ad.	219	70	38.5	7
60832	60832	1965	Mountain Spring, San Diego County, California.	May 12	♀ ad.	216	75	40	6
61157	61157	1967	.....do	May 13	♀ ad.	213	70	39	6.2
61162	61162	1973	.....do	May 14	♂ juv.	130	42	......	......
61163	61163	1974	.....do	....do...	♀ ad.	222	72	37	6.5
61164	61164	1976	.....do	May 15	♂ ad.	225	74	40.5	6
61165	61165	1977	.....do	May 16	♂ ad.	195	[c]50	38	......
61166	61166	3564	Jacumba, San Diego County, California.	May 22	♀ ad.	230	73	39	6.4
61167	61167	3580	.....do	May 24	♀ ad.	217	73	39	6.2
....	63089	3585	.....do	....do...	♀ ad.	220	75	39	6.5
60830	60830	1207	First water, at east base of Coast Range Mountains, near Mexican Boundary Line.	May 8	♂ im.	199	61	38	5.5
[a]8273	6612	1214	Mountain Spring, San Diego County, California.	May 9	♀ ad.	221	67	40	6.5
[a]8274	6613	1233	.....do	May 13	♀ ad.	206	59	36	6.5
60834	60834	1234	.....do	....do....	[d]♀ ad.	206	64	38	6.5
[a]8275	6614	1235	.....do	....do....	[d]♀.	213	70	38.5	8
[a]8279	6618	1288	Jacumba, San Diego County, California.	May 19	♀ ad.	227	80	36	7
60839	60839	1297	.....do	May 20	[d]♀ ad.	205	69	38	6.7
60840	60840	1324	.....do	May 23	♂ ad.	228	69	37	6.5
[a]8281	....	1325	.....do	May 24	♀ ad.	220	75	39	6.5
[a]8282	....	1334	.....do	...do....	♂ ad.	232	73	39	6.5
			Ammospermophitus leucurus interpres.	1892.					
20069	37036	1425	El Paso, Texas	Feb. 8	♂ ad.	227	71	37	......
20078	37037	1431	.....do	Feb. 11	♂ ad.	227	72	38	......
20070	35444	1473	.....do	Feb. 19	♂ ad.	226	73	38	6
20067	35442	1474	.....do	Feb. 20	♀ ad.	200	71	35	5.5
20068	35443	1487	.....do	Feb. 21	♂ ad.	220	70	40	5.5
20071	35445	1488	.....do	....do...	♂ ad.	213	60	37	5.5
20072	35446	1501	.....do	Feb. 23	♀ ad.	217	76	36	6
20075	35478	1524	.....do	Feb. 27	♂ ad.	227	73	38	5.6
20077	35449	1531	.....do	Mar. 2	♂ ad.	226	68	37	6.7
20076	35482	1532	.....do	Mar. 3	♂ ad.	(e)	......	37	6.3

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[a] American Museum of Natural History.

[b] End of tail gone.

[c] Tail abnormal.

[d] Mammæ five pairs.

[e] Head and body, 153 mm.

AMMOSPERMOPHILUS HARRISII (Audubon and Bachman).

HARRIS GROUND-SQUIRREL.

Spermophilus harrisii Audubon and Bachman, Quad. N. Am., III, 1857, p. 267, pl. CXLIV, fig. 1 (original description and figure).—Baird, Mam. N. Am., 1857, pl. XLVIII, fig. 3 (skull).—Coues, Amer. Nat., I, 1867, p. 359 (Western Arizona).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 51 (Syst. Results Study N. Am. Mam. to close of 1900).

Tamias harrisi, Allen, Monogr. N. Am. Rodentia, 1877, p. 810.—True, Proc. U. S. Nat. Mus., VII, 1885, p. 594.

[*Spermophilus*] *harrisii*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 85 (Synop. Mam. N. Am.).

[*Citelius* (*Ammospermophilus*)] *harrisi*, Elliot, Field Col. Mus., Zool. Ser., IV, 1904, p. 141 (Mam. Mid. Am.).

Yŭng-yī′-ŭh of the Hopi Indians of northeastern Arizona.

Hĭm-mē′-dä of the Hualapai Indians of northern Arizona.

Type-locality.—United States; exact locality unknown.[a]

Geographical range.—Sonoran Zone of the central region. On the Mexican Border, the typical form occurs only in the central portion of the Arizona section of the Boundary Line, whence its range extends northward beyond the Colorado River. In the desert ranges bordering the lower Colorado River it is represented by the subspecies *saxicola*.

Description.—Similar in size and color pattern to *Ammospermophilus leucurus*, but with a stronger coloration and a longer tail, which is not white below. Length, 230 mm.; tail vertebræ, 80; hind foot, 40; head, 45. Skull, 40 by 23. Mammæ, 5 pairs. Color above, a much-grizzled mixture of black and vinaceous-cinnamon. Outer surface of limbs, vinaceous-cinnamon, minutely grizzled. Under surface and orbital circle, white. A white stripe on each side extends from above the shoulder to the rump. Feet pale rusty. Tail rather bushy, iron gray above and below.

Habits and local distribution.—The Harris ground-squirrel is an abundant inhabitant of the open plains and desert regions of Arizona, and also invades the valleys, canyons, and river bottoms. It is the characteristic ground squirrel of Arizona, which territory is its center of abundance. Its range extends to all the surrounding country, the outline of its habitat lying within the boundaries of California, Nevada, Utah, New Mexico, and Mexico. In Arizona, it is restricted to the warm country under 5,200 feet in altitude, its vertical range corresponding, above, to the belt of cedar forests, although in certain instances it possibly extends through the cedars into the zone of rough-barked junipers which precedes the pine; but I have never met with it so high up. With the above definition of its range, it is unnecessary to enumerate the localities in which it has been found.

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[a] See Merriam, North American Fauna, No. 2, Oct. 30, 1889, pp. 19, 20.

In general terms, it may be said that it inhabits the whole Territory, except such limited areas as are too high and cold, and the southeast corner of Arizona. I have personally observed it throughout the length and breadth of Arizona. Some localities are interesting, however, as showing its proclivity for following up the canyons and water courses as far as possible, into regions elsewhere uninhabitable. Thus it was found in abundance in the deep canyon of the Colorado, although unable to withstand the rigors of the climate on the summit of the high bluffs bordering that stream; thence it penetrates the side canyons as far as possible, and was observed in the tributary canyon of Cataract Creek. It naturally reaches the highest elevation where there is a continuous slope from the low country with a very gradual alteration of the conditions. We found it in the cedar woods about Peach Springs, and along the Atlantic and Pacific Railroad as far as Aubrey Station (altitude 5,151 feet), living in large colonies in piles of loose rocks from railway cuttings. They were running actively about, notwithstanding the preceding night had been intensely cold, ice having frozen to the depth of 2½ inches in our camp kettle. The coats of several specimens from there were much denser and softer than any from the Verde Valley, taken at the same season.

In the valley of the Agua Fria, a tributary of the Gila, this species was found at the stage stations of Bumble Bee and Antelope, at a considerable altitude.

This ground-squirrel is abundant in the Verde Valley, where it derives its subsistence mainly from the dwarf form of mesquite growing there, beneath which wind the intricacies of its complicated burrows. It shares the terrestrial habits of the Say ground-squirrel; but there are few of the *Sciuridæ* that can not climb when tempting food is seen dangling overhead, and the golden bunches of ripe mesquite beans are sufficiently tempting to stimulate the present species to arboreal enterprise; and it may be seen awkwardly hugging the spiny branches or sunning itself on the limbs, with tail dropped, frequently uttering its hollow call-note. It lays up ample stores of mesquite seeds in its burrow, which doubtless accounts for its somewhat rare appearance above ground during the coldest weather. It has sufficient intelligence to husk the seeds from their long pods before carrying them under ground. The capacity of its cheek-pouches is considerable. Those of one that I shot contained 44 mesquite beans, in bulk just a thimbleful. Its mercurial temperament savors of the spiciness of its food. It is much heavier and stouter than the Gila or Rocky Mountain chipmunks, and is brimful of playfulness and noisy activity, delighting in the fierce power of the summer sun. As one rides over the mesquite flats, it scurries from underfoot, carrying its tail straight up in the air, uttering explosive chipperings as it hurries to the nearest mesquite bush, under whose shade it is quite certain of finding numerous holes by which to make its escape; but it oftener stops and chirrups saucily, stamping with its fore paws. Its curiosity is so great that a few sharp chirrups with one's lips will often bring it to the entrance of its burrow, or it may run directly up to within a few feet of one. Then it stops, stamps, and jerks its tail, presently beating an equally precipitate retreat and diving into its burrow with a loud note of alarm. Its call-note is a quick, hollow whistle; and it also utters metallic chirrups and chipperings suggestive of its impulsive nature. It very commonly sits up perfectly erect upon its hind feet, like the prairie-dog. The perpendicular carriage of its tail, when running, is characteristic. In the vicinity of Fort Verde the rutting season is from the middle of January to the middle of March, during which time the genitals of the male are enormously enlarged and the animal very active. A female killed on March 20 contained six fetuses of about the size and shape of small grapes. By the middle of July the young are half grown.

It inhabits the low banks and arroyos along the Verde River. The entrances of its burrows are numerous in these clay surfaces, and here the ground-squirrels frequently sit sunning themselves in cold weather. It is also found in the rocky slopes bordering the valley, but not so plentifully as in the rich river-bottom where its food is more abundant; but it even ascends farther, across the lower mesas to the cedar forests, where its range is abruptly limited by a high cliff or rim rock, bordering an elevated plateau. At the higher levels it feeds upon the fruitage and seeds of the Spanish bayonet, which I have found in large heaps under the stones, where it makes its home. There is snow occasionally at this altitude, but these ground-squirrels were seen running about more freely than those in the warm valley below.

One year, when the crop of mesquite mast failed, the Harris ground-squirrel migrated from the Verde Valley in large numbers, so that the species was comparatively rare for a whole year.

This ground-squirrel is to some extent carnivorous, as is well known to be the case with the prairie-dog and the large ground-squirrel (*Otospermophilus grammurus*) of this region. I have poisoned it upon the carcass of a cougar, whose flesh was poisoned with strychnine.

On the Mexican Boundary the Harris ground-squirrel was not observed east of the Pajaritos Mountains, but was plentiful in rocky country, thence west to the Colorado River, grading into the subspecies *saxicolus* west of Quitobaquita. In 1884 it was noted about the San Carlos Agency. In 1885 I traced it from Fort Verde through the Agua Fria Valley, the Black Canyon, Desert Well, Phoenix, Casa Grande, Sweet Water, and the Santa Cruz Valley. In 1893 and 1894 the range of the typical form was traced through the Santa Cruz Valley into Sonora, Mexico. In December, 1893, it was abundant in a pass of the Pozo Verde Mountains, Sonora, near Monument No. 141;

also observed at Laboree's ranch and the Tucson Mountains, on the road to Tucson, Arizona. In December, 1893, and January following, while camped at Pozo de Luis, Sonora, it appeared to be uncommon. It was said to abound at Sonoyta, Sonora, but not many were seen owing to the cold weather. One was noted at Santo Domingo, on the Sonoyta, and some species of ground-squirrel was said to occur numerously on Nariz Mountain. At Quitobaquita, Pima County, Arizona, we found it common from January 25 to February 8, 1894. Some were seen on rough granite hills, others on the flat river bottom overgrown with the creosote bush, sagebrush, and greasewood. Those taken in traps had mesquite beans in their cheek-pouches.

AMMOSPERMOPHILUS HARRISII SAXICOLA (Mearns).

ROCK-SQUIRREL.

Spermophilus harrisii saxicolus Mearns, Proc. U. S. Nat. Mus., XVIII, No. 1075, May 23, 1896, p. 444 (advance sheet published Mar. 25, 1896).

[*Spermophilus harrisii*] *saxicolus*, Elliot, Field Col. Mus., Zoöl. Ser., II, 1901, p. 86 (Synop. Mam. N. Am.).

Spermophilus harrisii saxicola, Miller and Rehn, Proc. Bost. Soc. Nat. Hist., No. 1, XXX, Dec. 27, 1901, p. 51 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Citellus harrisi*] *saxicola*, Elliot, Field Col. Mus., Zoöl. Ser., IV, 1904, p. 142 (Mam. Mid. Am.).

Citellus (*Ammospermophilus*) *harrisi saxicolus*, Trouessart, Catal. Mam., Suppl., 1904, p. 335.

Type-locality.—Tinajas Altas, Gila Mountains, Yuma County, Arizona. (Type, skin and skull, No. 59869, U. S. National Museum.)

Geographical range.—Mountain ranges of the Western Desert, in the Lower Sonoran Zone of Arizona and Sonora.

Description.—Similar to *Ammospermophilus harrisii*, but much paler, with the light markings everywhere increased in extent and with a much longer tail. Length, 245 mm.: tail vertebræ, 95; ear from crown, 5; hind foot, 40. Skull (fig. 48), 40 by 23. Mammæ, 5 pairs.

Remarks.—This is a long-tailed, pallid, desert race, inhabiting bare granite ranges of mountains, extending in a southeasterly direction from the Gila River, in southwestern Arizona (Yuma County), into western Sonora.

Ammospermophilus harrisii was described by Audubon and Bachman from a specimen from an unknown locality. In naming the present subspecies it became expedient to restrict the name *harrisii* to the darker form, which was found in the Elevated Central Tract, along the Mexican Boundary Line, from the Santa Cruz Valley westward as far as the Sonoyta, where intergrades were taken at Quitobaquita.

Habits and local distribution.—I heard the twitter of one of these rock-squirrels in the mountains five miles east of Tule Wells, February

9, 1894. They were subsequently taken in the Tule, Granite, and Gila mountains. As we traveled north from Tinajas Altas, east of the Gila Mountains, it was last noted on the plain midway between Tinajas Altas and Adonde, on the Gila River, and was not again seen until we reached Gila City on the Gila River at the northern extremity of the Gila Mountains. None were observed on the lower course of the Colorado River.

During February, 1894, the rock-squirrel was found in abundance in the vicinity of Tinajas Altas, numbers having been attracted to the locality from the surrounding country by the grain spilled by the draft animals of the Survey. A single trap, conspicuously placed on a rock near my tent, kept me fully occupied with skinning specimens of it which were caught. In the Granite Mountains its capacious cheek-pouches were usually distended with mesquite seeds. Three females, taken February 16 to 19, 1894, each contained 6 large fetuses, showing that the young are born with some uniformity late in February, as no young were seen up to that season.

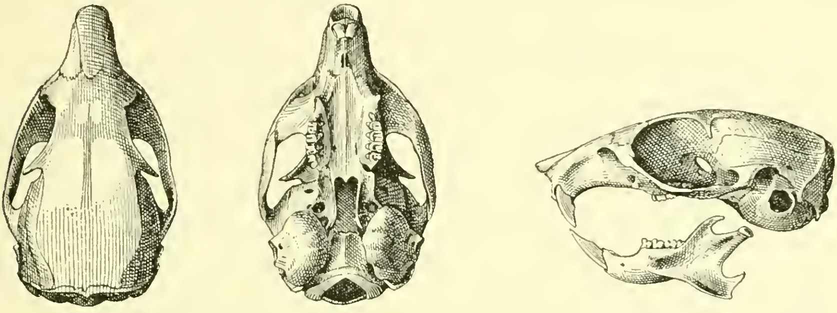

FIG. 48.—AMMOSPERMOPHILUS HARRISII SAXICOLA. (TYPE, CAT. NO. 59869, U.S.N.M.) *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

Measurements of 53 specimens of the Ammospermophilus harrisii group.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Height of ear above crown.
Skin.	Skull.								
			Ammospermophilus harrisii.	1884.		*mm.*	*mm.*	*mm.*	*mm.*
*a*12155	In skin..	93	Fort Verde, Arizona	Apr. 8	♂ ad.	251	86	36.4	......
*a*2234	In skin..	94	.....do..........	Apr. 15	♂ ad.	235	80	35	......
*a*2235	In skin..	107	.....do..........	June 26	♀ juv.	190	67	......	......
*a*2236	In skin..	125	.....do..........	Sept. 10	♂ ad.	243	80	36	9
*a*2237	In skin..	129	.....do..........	Sept. 19	♂ ad.	217	70	35	10
*a*2238	In skin..	130	.....do..........	....do...	♀ juv.	214	70	......	......
*a*2239	....	150	12 miles east of Peach Springs, Mohave County, Arizona.	Nov. 20	♀ ad.	217	53	38	9
*a*2240	....	151	.....do..........	....do...	♀ ad.	221	66	38	8
*a*2241	....	152	.....do..........	....do...	♀ ad.	232	75	38	

Measurements of 53 specimens of the Ammospermophilus harrisii group—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Height of ear above crown.
Skin.	Skull.								
			Ammospermophilus harrisii—Continued.	1885.		*mm.*	*mm.*	*mm.*	*mm.*
[a]12153	Inskin..	166	Fort Verde, Arizona............	Jan, 24	♂ ad.	225	72	40	10
[a]2212	1379	173	20 miles north of Phoenix, Arizona.	Mar. 28	♀ ad.	227	80	38	5.5
[a]2244	1380	229	Fort Verde, Arizona............	Aug. 17	♂.	229	82	41	8
[a]2245	1381	230	.....do	....do...	♂.	215	75	42	8
[a]2246	1382	231	.....do	....do...	♂.	233	89	41	8
[a]2247	1383	234	.....do	Aug. 28	♀ ad.	229	80	39	6
[a].....	....	235	.....do	....do...	♀ ad.	220	76	38	6.6
[a]2248	1384	287	.....do	Dec. 8	♂ ad.	236	73	39	8
				1886.					
[a]2249	1879	308	.....do	Jan. 30	♂ ad.	232	80	40	7
[a]2250	1385	337	.....do	Mar. 19	♂ ad.	235	80	41	7
[a]2251	....	339	.....do	Mar. 20	♂ ad.	228	79	40	6.5
[a]2252	....	340	.....do	....do...	♀ ad.	232	75	37.5	6
[a]12156	1386	342	.....do	....do...	♀ ad.	234	86	40	5.5
[a]12154	1387	343	.....do	....do...	♂ ad.	237	86	41	6
[a]2253	1388	344	.....do	....do...	♂ ad.	227	88	41	6.5
[a]2254	....	345	.....do	Mar. 22	♀ ad.	237	80	40	6
[a].....	1389	372	.....do	Apr. 8	♂ ad.	238	86	39	6
[a]2255	....	388	.....do	Apr. 17	♂ ad.	238	83	40	5.5
				1887.					
....	....	476	.....do	Jan. 18	♂ ad.	247	86	40	9
				1888.					
....	....	658	.....do	Apr. 25	♂ ad.	245	80	40	7
				1893.					
59231	59231	2746	La Osa, Pima County, Arizona..	Dec. 28	♂ ad.	223	85	39	5
59232	59232	2747	Pozo Verde, Pima County, Arizona.	....do...	♀ ad.	232	90	39	6
				1894.					
59282	59282	2767	Pozo de Luis, Sonora, Mexico..	Jan. 5	♂ ad.	239	90	40	6
59882	59882	2837	Quitobaquita, Monument No. 172.	Jan. 26	♀ ad.	239	94	39	6
59865	59865	2875	.....do	Jan. 31	♂ ad.	......	......	39	6
59861	59861	2876	.....do	....do...	♀ ad.	230	86	40	6
59863	59863	2935	.....do	Feb. 6	♂ ad.	246	92	42	5
59862	59862	2936	.....do	....do...	♀ ad.	225	83	41	4.5
			Ammospermophilus harrisii saxicola.						
....	63143	2949	Tule Wells, near Monument No. 186.	Feb. 11	♀.	220	85	37.5	......
59875	59875	2961	Tule Mountains, Mexican Boundary Line.	Feb. 13	♂ ad.	238	91	40	5
59883	59883	2962	.....do	....do...	♀ ad.	236	85	39	5
59867	59867	2968	Tinajas Altas, Yuma County, Arizona.	Feb. 15	♂ ad.	245	92	40	5
59870	59870	2969	.....do	....do...	♂ ad.	222	85	38.5	4.5
59868	59868	2970	.....do	....do...	♀ ad.	230	82	40.5	4.5
59871	59871	2976	.....do	Feb. 16	♂ ad.	233	80	39	5

[a] American Museum of Natural History.

Measurements of 53 specimens of the Ammospermophilus harrisii group—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Height of ear above crown.
Skin.	Skull.								
			Ammospermophilus harrisii saxicola—Continued.	1891.		*mm.*	*mm.*	*mm.*	*mm.*
59878	59878	2977	Tinajas Altas, Yuma County, Arizona.	Feb. 16	♂ ad.	233	85	39	4.7
59866	59866	2978	.....do	.....do...	♀ ad.	232	90	38	5
59872	59872	2979	.....do	.....do...	[a]♀ ad.	238	87	39.5	5
59873	59873	2980	.....do	.....do...	♂ ad.	245	92	41	5
59877	59877	2981	.....do	.....do...	♂ ad.	233	85	40	4.8
59876	59876	2982	.....do	.....do...	♀ ad.	223	81	39	5
59869	59869	[b]2983	.....do	.....do...	[c]♀ ad.	245	93	40	5
59879	....	2997	.....do	Feb. 19	[c]♀ ad.	227	81	39	5
59880	....	2998	.....do	.....do...	[c]♀ ad.	243	90	39	4.9

[a] Mammæ, five pairs.

[b] Type.

[c] Contained six large fetuses; preserved in alcohol. No. 61527, U.S.N.M., body with six fetuses; preserved in alcohol.

Genus CALLOSPERMOPHILUS Merriam (1897).

Callospermophilus MERRIAM, Proc. Biol. Soc. Washington, XI, p. 189, July 1, 1897, footnote ("and *lateralis* is the type of a very distinct subgenus of *Spermophilus*, which I here name *Callospermophilus*"); XIV, p. 126, July 19, 1901; Proc. Washington Acad. Sci., III, p. 563, Nov. 29, 1901.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 46, footnote (Syst. Results Study N. Am. Mam. to close of 1900); XXXI, Aug. 27, 1903, p. 75 (Syst. Results Study N. Am. Mam. during the years 1901 and 1902).—ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 82. fig. 17 (skull of type); IV, 1904, p. 147 (Mam. Mid. Am.).

Characters.—Body with three longitudinal stripes (one whitish and two black) on each side; a golden mantle over head and shoulders; mammæ, 5 pairs (in one specimen of *C. lateralis*, 4 pairs); tail cylindrical, hairy; external ears developed to a degree intermediate between those of *Ammospermophilus* and *Eutamias;* skull very similar to that of *Citellus citellus* (Linnæus), much broader than in *Ammospermophilus* or *Eutamias*, with relatively shorter rostrum, broader nasals, longer interpterygoid fossa, and broader basioccipital; skull highest opposite tips of postorbital processes; first premolar smaller than in *C. citellus*, but relatively larger than in *Ammospermophilus* or *Eutamias*.

CALLOSPERMOPHILUS LATERALIS (Say).

SAY GROUND-SQUIRREL.

Sciurus lateralis SAY, Long's Expedition to the Rocky Mountains, II, 1823, p. 46. (original description).

Arctomys (*Spermophilus*) *lateralis*, RICHARDSON, Zool. Journ., III, April, 1828, p. 519; Fauna Boreali-Americana, I, 1829, p. 174, pl. XIII.

Spermophilus lateralis, F. Cuvier, Suppl. Buffon, I, Mam., I, 1832, p. 335.—Baird, Mam. N. Am., 1857, p. 312.—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 51.

Tamias lateralis, Allen, Proc. Bost. Soc. Nat. Hist., XVI, 1874, p. 299; Monogr. N. Am. Rodentia, 1877, p. 814.—Coues and Yarrow, Wheeler Surv., V, Zool., 1875, p. 119 (Apache, Arizona).—Merriam, North American Fauna, No. 2, 1890, p. 53 (San Francisco Mountain, Arizona).

[*Spermophilus*] *lateralis*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 83 ["*Spermophilus* (*Callospermophilus*) *lateralis*," fig. 17]. (Synop. Mam. N. Am.)

C[*itellus*] *lateralis*, Elliot, Field. Col. Mus., Zool. Ser., IV, 1904, p. 147, in text (Mam. Mid. Am.).

Yŭng-yī′-ŭh, of the Hopi Indians of northeast Arizona.

Type-locality.—"Arkansas River, lat. 38° 25′; long. 105° 20′," a few miles below Canyon City, Colorado.

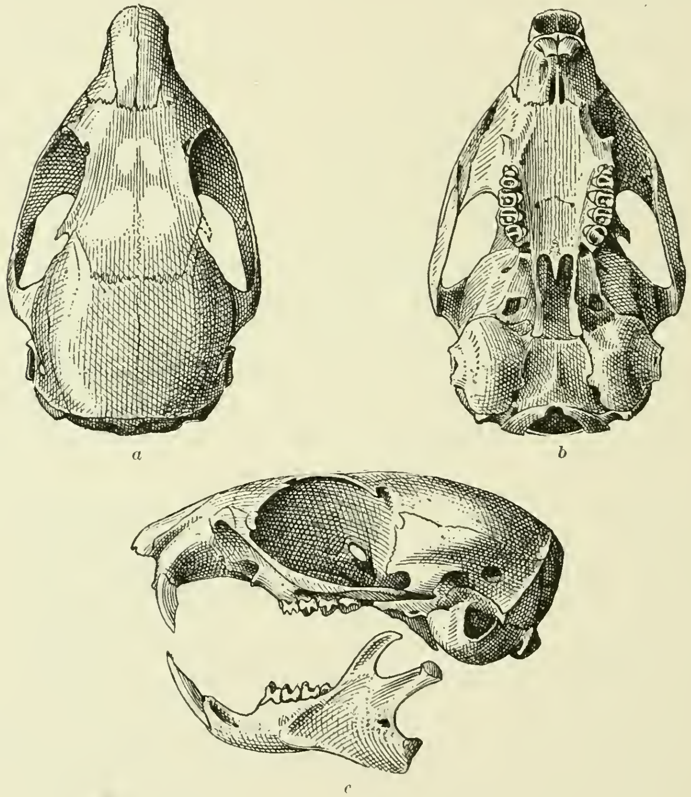

Fig. 49.—Callospermophilus lateralis. San Francisco Mountains, Arizona. (Cat. No. 22747, U.S.N.M.) *a*, Dorsal view; *b*, Ventral view, *c*, Lateral view

Geographical range.—Transition and Lower Boreal zones of mountains of the Colorado Plateau, in Arizona, New Mexico, and northward.

Description.—About the size of *Sciurus hudsonicus.* Length, 275 mm.; tail vertebræ, 100; ear from crown, 15: ear from notch, 22; hind foot, 43; head, 50. Skull, 45 by 26. Mammæ, 4 pairs. Pattern striped, as in *Tamias* and *Eutamias*, but without a median dorsal stripe. A broad white stripe extends along the side, from shoulder to thigh, narrowing posteriorly; and this is bordered above and below by black, the lower black stripe being the most pronounced. The rest of the upper side of the body is grizzled vinaceous cinnamon, intimately mixed with black anteriorly, and more vinaceous posteriorly. Crown, cheeks, sides of neck, shoulders, and outer aspect of limbs vinaceous cinnamon. Side of head with a whitish line extending from nose to ear, involving the eye; underside of head, white. Sides of body yellowish, paler and grayer next to the black longitudinal stripes. Under surface of body, soiled yellowish white. Tail grayish yellow, sometimes vinaceous, the lateral hairs thrice ringed with black. Ears coated with short, ferruginous hairs, both surfaces, white at base anteriorly.

Skull.—The skull (fig. 49) of *Callospermophilus lateralis* differs widely from those of *Ammospermophilus leucurus* and *A. harrisii*. In fact, the *lateralis* group stands out distinctly from both the genera *Tamias* and *Eutamias*, and from *Ammospermophilus*, and merits separation as a section of the genus *Citellus*. (Since the above was written it has been named *Callospermophilus* by Merriam, and regarded as a full genus.)

The skull closely resembles that of typical *Citellus* (*Mus citellus* Linnæus). The brain case is less flattened superiorly than in *Ammospermophilus*, with more prominent and higher parietal crests. The audital bullæ are smaller, and the width of the basi-sphenoid, basi-occipital, and interpterygoid notch relatively much greater. The incisive foramen is longer.

Cranial measurements of 4 adult females of Callospermophilus lateralis from near Flagstaff, Arizona.

American Museum number.	Original number.	Sex.	Total length.	Greatest breadth.	Height of skull.	Distance between orbits.	Nasal bones, length.	Nasal bones, width before at widest point.	Upper incisors, from front to posterior margin of palate.	Length of upper molariform series.	Greatest width across upper molars (measured on outside of crown.)	From posterior border of incisors to foramen magnum.	Antero posterior diameter of audital bullæ.	Greatest breadth of zygoma.	Length of mandible measured from condyle.	Length of under molariform series.
			mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
1360	421	♀.	44.5	28.5	18	11.1	15.2	6.8	21	9	12	37	......	3	28.5	8.6
1359	425	♀.	45	28.5	18	11.4	15.1	6.5	23.5	8.5	11.2	37.3	10.1	2.8	27.5	8.7
1362	426	♀.	43.5	28	18	10.4	15.1	6.5	23	8.6	12	35.5	9.5	3	27	8.5
1363	427	♀.	44	......	....	11	15	6.3	22.5	8	12	......	......	2.8	27.5	9

Remarks.—The larger ears, and the addition of black longitudinal stripes, are in the direction of the genera *Tamias* and *Eutamias*; but the skull and teeth are unmistakably citelline. In *C. lateralis* the first upper premolar is smaller than in the remaining species of *Callospermophilus*, and the mammæ are four pairs, as in *Tamias*, *Eutamias*, and *Sciurus*. In *C. chrysodeirus*, a species of this group from Fort Klamath, Oregon, the mammæ are five pairs, and the first upper premolar much larger, in this respect approaching *Citellus citellus* (Linnæus).

Life history.—This, the type of the genus *Callospermophilus*, is an alpine species of the wooded mountain regions of the interior of the United States. In Arizona, its range is nearly coextensive with that of the Arizona chipmunk (*Eutamias cinereicollis*), though it descends to a somewhat lower altitude in certain places. It is recorded by Doctors Coues and Yarrow from the vicinity of Fort Apache, whence I have traced it along the Mogollon Mountains to the San Francisco Range. In ascending the northwestern extremity of the Mogollon Range, either to the north or east of Fort Verde, it was not met with below 6,000 feet. It descends lower in the White Mountain region and occurs at various points in the adjacent Territory of New Mexico.

The Say ground-squirrel, although generally distributed over the elevated region of its habitat in Arizona, is somewhat colonial, often living in large communities where food is plentiful. As its food consists largely of low, green vegetation, it is quite as terrestrial as the Harris chipmunk, seldom climbing trees, but showing great adaptability for movement amid the rocks and prostrate timber of its forest home. As one rides through the woodland it is seen perched on stones and fallen timber, or nimbly running about among the branches and decayed trunks of fallen forest monarchs. It often sits erect on its hind feet with its paws dropped by its sides, uttering a high-pitched whistle which is ventriloquial in character, seeming to proceed from the nearest treetops whilst in reality it comes from the ground at a much greater distance. It is quite the reverse of shy, being often so regardless of your presence as to run almost under your horse's feet, and in camp its curiosity and audacity are boundless. The young are brought forth in June or July in burrows under logs or stones. Its nest is bulky, being composed of dry grass or any soft material at hand, such as wool or hair, if living in the neighborhood of grazing camps.

When in camp on the western side of Humphreys Peak of the San Francisco Mountains, in June, 1887, these ground-squirrels were found ranging nearly to the timber line, in company with the Mogollon chickaree and the Arizona chipmunk. At Antelope Spring (altitude 8,065 feet) in the same region they were annoyingly familiar, entering my tent during my absence and appropriating my cotton to build nests with and eating whatever scraps of food could be found. They even dared to enter boldly when I was within, engaged in preparing specimens. They would devour the flesh of the birds and mammals skinned, and several were killed near our camps by eating poisoned meat laid for wolves and large game. In the logging camps around Flagstaff and along the then new Mineral Belt Railroad they occasioned much inconvenience by their persistent pilfering of grain and food stores.

At Fern Spring, near Bakers Butte, in the Mogollon Range east of Fort Verde the young were running about by the middle of July. There they became particularly bold and troublesome, carrying off everything eatable that they could find in our summer camp. It was next to impossible to preserve our horses' forage. When once they gained access to a sack of grain, they made bold to carry it off into their underground storehouses before our eyes. They openly frequented our cook tents, abstracting therefrom whatever they wanted and could carry. They nibbled at our bacon and salt pork and approached our mess table at meal times entreating to be fed. Though an awkward load, one could manage to carry away a large camp biscuit, an amusing performance. Among them was an albino and several more or less albinistic individuals. Many were trapped, but they were so abundant that there was no perceptible diminution of their numbers. The soldiers carried a number of them to Fort Verde (altitude only 3,300 feet) as pets; some escaped and took up their abode beneath the quarters, where they thrived, increased, and became a nuisance.

CALLOSPERMOPHILUS BERNARDINUS (Merrriam).

SAN BERNARDINO MOUNTAIN GROUND-SQUIRREL.

Spermophilus chrysodeirus brevicaudus MERRIAM, Proc. Biol. Soc. Washington, VIII, p. 134, Dec. 28, 1893. (Not of Brandt, 1844.)

Spermophilus (*Callospermophilus*) *bernardinus* MERRIAM, Science, New Ser., VIII, p. 782, Dec. 2, 1898.

Spermophilus bernardinus, MILLER and REHN, Proc. Bost. Soc. N. H., XXX, No. 1, Dec. 27, 1901, p. 47 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Spermophilus chrysodeirus*] *bernardinus*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 84 (Synop. Mam. N. Am.).

The following is the original description:

Type from San Bernardino Peak, California. No. 56661, female adult, U. S. National Museum, Department of Agriculture collection. Collected October 9, 1893, by J. E. McLellan (original number, 274).

General characters.—Similar to *S. chrysodeirus*, but with much shorter tail, somewhat shorter hind foot, and duller mantle over head and shoulders. The tail averages about 75 mm., while that of *chrysodeirus* averages 90 mm. or more.

Color (of type-specimen).—Back and rump grizzed gray tinged with brownish; sides paler; a dull fulvous mantle over head and neck, hardly reaching the shoulders; color of head shading toward brick-red; sides of neck behind ears buffy ochraceous; a broad whitish stripe, bordered on each side by a broad black stripe, extends from the shoulder to the rump on each side, and the white reaches beyond the black in both directions; hind foot dull whitish; tail above, proximal half grizzled; distal half black, edged with fulvous; tail below, chestnut, bordered with black and edged with fulvous.

Number of specimens examined, 7; all from San Bernardino Mountains, California. (Proc. Biol. Soc. Washington, VIII, 1893, p. 134.)

Measurements of 21 specimens of Callospermophilus lateralis.

Museum number.[a]		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Height of ear above crown.
Skin.	Skull.								
				1886.		*mm.*	*mm.*	*mm.*	*mm.*
3728	1360	424	Flagstaff, Arizona	June 21	♀ ad.	249	75	40	15
	1359	425	do	June 20	♀ ad.	270	90	......	16
	1362	426	Near Flagstaff, Arizona	do	♀ ad.	283	96	......	14
	1363	427	do	do	♀ ad.	270	88	......	14
2198	1361	437	do	July 22	♀ ad.	278	97	42	16
				1887.					
2199	1364	539	Near Stonemans Lake, Arizona	May 23	♂ ad.	276	103	43	15
3728	1365	540	do	do	♂ ad.	290	101	42	19
3729	1366	541	do	do	♀ ad.	281	96	41	16
3730	1367	542	do	do	♀ ad.	281	102	42	16
2200	1368	549	Quaking Asp Settlement, Mogollon Mountains, Arizona.	May 26	♀ ad.	278	105	43	14
2201	1369	551	do	May 27	♀ ad.	269	91	42	15
	1370	564	Mormon Lake, central Arizona	May 28	♂ ad.	294	104	46	17
2202	1371	573	Near Flagstaff, Arizona	June 1	♀ ad.	271	95	42	13
	1372	584	San Francisco Mountain, Arizona	June 8	♂ ad.	279	101	41	16
2203	1373	604	Bakers Butte, Mogollon Mountains, Arizona.	July 14	[b]♀ ad.	272	104	42	18
12209	1374	605	do	do	♀ ad.	269	99	41	14.5
12210	1375	617	do	July 31	♂ ad.	280	103	43	15
2206	1376	618	do	do	♂ ad.	269	93	43	16
2207	1377	619	do	Aug. 1	♂ ad.	278	96	44	13
	....	631	do	Aug. 21	♀ ad.	270	90	......	......
				1888.					
2256	....	659	do	Apr. 28	♀ ad.	259	97	40	13

[a] American Museum of Natural History.

[b] Mammæ, 4 pairs.

Genus OTOSPERMOPHILUS Brandt (1844).

Otospermophilus Brandt, Bull. Classe Physico-math. de l'Acad. Imp. des Sci. de St. Petersbourg, II, 1844, p. 379. (Species included: *Spermophilus grammurus*, *S. mexicanus*, and *S. lateralis.*)—Baird, Mam. N. Am., 1857, p. 305. (Eliminated *S. mexicanus.*)—Allen, Mon. N. Am. Rodentia, 1877, p 821. (Eliminated *S. lateralis*, leaving *S. grammurus* the type.)

Characters.—Ears large, high, pointed (larger and more pointed than in some species of *Sciurus*); tail long, full, and broad, with the hairs two-thirds to three-fourths the length of the head and body; general form of the skull, and the dentition, strongly Sciurine. (*J. A. Allen.*)

OTOSPERMOPHILUS GRAMMURUS (Say).

ROCK-SQUIRREL; CANYON-SQUIRREL.

Sciurus grammurus SAY, Long's Expedition to the Rocky Mountains, II, 1823, p. 72 (original description).

Spermophilus grammurus, BACHMAN, Charlesworth's Magazine Nat. Hist., III, 1839, p. 390.—BAIRD, Proc. Acad. Nat. Sci. Phila., 1855, p. 334; Mam. N. Amer., 1857, p. 310, pl. IV (animal); Rep. U. S. and Mex. Bound. Surv., II, Pt. 2, 1859, p. 38.—COUES, Amer. Nat., I, 1867, p. 360; Proc. Acad. Nat. Sci. Phila., 1867, p. 135.—MERRIAM, U. S. Geol. Surv. Terr. 6th Ann. Rept., 1873, p. 663.—COUES and YARROW, Wheeler Surv., V, Zool., 1875, p. 121.—ALLEN, Bull. Am. Mus. Nat. Hist., III, p. 223, No. 2, April 29, 1891 (Presidio County, Texas).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 49.

Spermophilus (*Otospermophilus*) *grammurus*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, fig. 19 (Synop. Mam. N. Am.).

[*Citellus* (*Otospermophilus*) *variegatus*] *grammurus*, ELLIOT, Field Col. Mus., Zool., Ser., IV, 1904, p. 149 (Mam. Mid. Am.).

Hĭm-mē′-lē-dä of the Hualapai Indians of northern Arizona.

Lä-cä′-nă of the Hopi Indians of northeastern Arizona. Rocky Mountain line-tailed spermophile of authors.

Type-locality.—Headwaters of the Arkansas River, now within the State of Colorado.

Geographical range.—Sonoran, Transition, and Lower Boreal zones of the southern interior region; from the upper Rio Grande Valley west to La Osa (Monument No. 140), at the eastern edge of the Western Desert Tract.

Description.—Size large (larger than the eastern gray squirrel); with large ears, a stout body, and a bushy tail. Mammæ, 5 pairs. Not striped. Color above grayish; below yellowish white. The upper surface is a coarse mixture of black and grayish or brownish white, the hairs being blackish at base and tip and ringed with whitish in the middle portion, the arrangement of the annuli being such as to produce a vermiculate pattern. Top of head and ears much mixed with black. Anterior portion of body usually clear grayish; posterior portion more or less washed with yellowish brown. Tail grizzled black and white, the hairs thrice banded with blackish and thrice with whitish, the tips being whitish. Feet and chin brownish white. Orbital circle and under surface of body yellowish white at surface, plumbeous at base of hairs. Length, 490 mm.; tail vertebræ, 220; hind foot, 62; ear above crown, 19; ear above notch, 25; length of head, 70. Skull, 62 by 37 mm. in greatest diameters.

Remarks.—The summer pelage is not materially different from that of winter. The winter pelage appears to be worn until near the end of July,[a] though molting begins about the second week of July and continues through August. Only a few individuals have acquired the perfect summer pelage by August 20, and one female had not completed the change by September 16. This change takes place in masses. In August it is usual to see individuals in perfect summer garb as to the anterior half of their bodies, though without a particle of overhair on the posterior half, excepting the tail, which retains the winter coating until this time, new hair beginning to appear just as the summer coat has proceeded backward from the nose to a point behind the shoulders. Twenty adults, taken from September 3 to December 21, fail to show clearly the progress of the change from summer to winter coat, though a considerable change does take place, as is instantly appreciated when specimens in fresh summer coat are compared with those taken in December, when the winter coat is prime. In the summer pelage underfur is absent on the belly, the skin appears between the sparse overhair, and the hair is short throughout. In winter the belly is well covered with underfur, and the entire coating longer. There are no positive color differences. In July and August the posterior half of the body usually becomes sunburnt, and changes to a dull, brownish color. When the overhair falls out in masses the plumbeous underfur soon changes to the same brown color until replaced by the incoming summer pelage. Lactation seems to exert but little influence upon the season of molting. Males acquire the summer coat, as a rule, no earlier than females. Quite young specimens were collected from July to November, showing that the season of reproduction is quite irregular or that more than one litter of young is raised in a season. The young are similar to their parents, but with the colors brighter and often more strongly washed with brownish posteriorly.

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[a] Females containing young were killed June 14 and 27.

Cranial measurements of 14 adults of Otospermophilus grammurus from the Verde Basin, Arizona.

Museum number.[a]	Original number.	Sex.	Total length.	Greatest breadth.	Height of skull.	Distance between orbits.	Nasal bones, length.	Nasal bones, width before at widest point.	Upper incisors from front to posterior margin of palate.	Length of upper molariform series.	Greatest width across upper molars (measured on outside of crown).	From posterior border of incisors to foramen magnum.	Antero-posterior diameter of audital bullæ.	Greatest breadth of zygoma.	Length of mandible measured from condyle.	Length of under molariform series.
			mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
1698	221	♂	60.5	39	25.6	16.5	21.3	10	34.5	12	17.2	50	13.2	5.1	40	12.5
1641	366	♀	58	36.2	24.5	15	21	8.5	31	12	16.7	47.5	12.5	4	38	11.5
1645	367	♀	59	35.5	23	15	21.3	8.5	31.5	12.2	16	48.5	12.4	3.9	37	12.5
1643	370	♂	57.8	36	25.5	15.5	21.8	8.4	32.5	12.1	16	47	13	3.8	38.3	12
1649	371	♂	61	39	24.7	15.8	23	9	34.5	13	16.4	49	13	4	40	12
1647	389	♀	58.2	34	23.2	13.5	20.6	8.4	32	12.4	15.3	46.5	12.2	3	36	11.3
1646	390	♂	59.3	36.5	24.5	14.6	21.8	9.4	34.5	12	16	49	12.6	4	38.7	11.9
1650	397	♂	62	37	24.2	16	22.2	10	34	13	17	50.5	13.8	5.1	41	12.9
1651	398	♀	60	35.4	24	14.5	21.5	8.8	33.5	12.4	16.6	49	13.2	4	40	12.4
1649	399	♀	59.5	37	24.3	14.7	20.8	8.4	33	12	16.1	49	12.8	4.1	40	12
1639	400	♀	60.8	38	25	15.2	22	9.8	34	13	16.5	50	14	4.9	38.5	11.5
1644	409	♀	59	37	24	15	21	9	33	12	16	48.5	13	4	39	12.1
1653	423	♀	58.7	35.5	23	14.8	20	9	33	12.4	16.2	47.5	13	3.1	37.8	12.3
1642	430	♀	59	......	23.5	13	20.2	9	33	12.8	16.1	48	13	3.8	......	12.2

[a] American Museum of Natural History.

The form of the Eastern Desert Tract is extremely pale and doubtless separable as a geographic race, but we got no specimens representing the extreme of this phase. During February and March none appeared at El Paso, Texas. The first one was seen in the Carrizalillo Mountains, Chihuahua. It was wounded, but escaped among the rocks in which it lived, and no specimen was obtained until we reached the edge of the Elevated Central Tract, where the form begins to lose its extreme pallor.

Habits and local distribution.—This large ground-squirrel of the southern Rocky Mountain region is the only one of the *Sciuridæ* whose distribution is general throughout the territory of Arizona. It is alike at home in the low, desert regions and in the highest mountains. I found it at the summit of the San Francisco Mountains, the highest land in the territory, in June, 1887. It appeared to be the only species of the family living above timber-line in those mountains, the bighorn, or mountain sheep, being the only other mammal known habitually to frequent the summit.

This species, in Arizona designated as the "rock-squirrel" or "canyon-squirrel," is both widely known and held in general disfavor, from its abundance and its destructiveness to crops. In appetite it is as omnivorous as the bear, feasting alike upon flesh, carrion, grain, or almost any sort of fruit or green vegetation that chances to be in season.

Its flesh, though reputed to be very good, is seldom eaten, save by Indians. Many persons referred to it with abhorrence, recalling the current tales of its supposed interference with the graves of miners buried in the mountains, which tales, doubtless, are not wholly without foundation.

At high altitudes, this rock-squirrel hibernates in winter. At Whipple Barracks (altitude 5,318 feet), General Crook had dormant specimens brought to him in winter by Hualapai Indians. In the Verde Valley (altitude 3,160 feet) it is much less active during winter, but was seen at all seasons, coming out oftenest when the sun was shining, and during the warmest part of the day in winter.

Although manifesting a decided preference for rocky places, as cliffs, canyons, and huge piles of rocks, which abound in many parts of the Territory, this ground-squirrel is quite ubiquitous. In river bottoms, and on the open plains, it excavates a burrow beneath a stone or bush—preferably a mesquite—and readily adapts its habits to its environment. Its appetite, likewise, seems to be governed by convenience rather than by any very decided preferences. In the vicinity of cultivated lands maize, barley, and wheat are staple articles of its diet, while in river flats the mesquite and screw bean constitute the largest elements of its food. The stomachs and cheek-pouches of the specimens shot in the neighborhood of Fort Verde, in central Arizona, contained a large variety of substances, varying according to season and surroundings. Among them were berries of the cedar, sumac and hackberry, grapes, walnuts, acorns, grass seeds, corn, barley, and, in spring and summer, numerous kinds of green herbs, and browsing. In the Mogollon Mountains I found its capacious cheek-pouches filled with bulbs of a liliaceous plant, which the Mexicans called by a name signifying artichoke. In spring it feeds largely on the fruitage of the willow, and may then be seen perched in willow trees, frequently in the very top, where it prefers to remain quiet when approached, as it is too clumsy at climbing to attempt to beat a hasty retreat from its arboreal position. The mesquite bean is eaten with avidity. In September its pouches were filled with the unripe fruit, in the pod; at other seasons only the seeds are eaten. A small, prostrate herb, known as "filere grass," or "alfilerea," said to have been recently introduced from California by shepherds, now naturalized and diffused, furnishes it with very satisfactory grazing in early spring. Specimens shot at Fort Verde in April had their stomachs distended with the good-sized ovaries of some plant, containing a quantity of green seeds.

This ground-squirrel is a source of much inconvenience to such of the Indians as are engaged in agriculture. It betakes itself to their fields as soon as the cereals and Indian corn are planted, digging up the seeds and nibbling off the tender blades. When the harvest ripens, they carry enormous quantities of the ripe grain into their burrows and rocky fastnesses for future use. In the settlement of the Havasupai Indians, in the deep canyon of Cataract Creek, a tributary of the Great Colorado, I saw in November numerous large caches of maize stored in excavations in the limestone cliffs, which were walled in front and carefully plastered. This, the Indians said, was a necessary precaution against the ravages of this squirrel and the wood rat (*Neotoma*), both of which rodents were very abundant in the canyon. These storehouses were opened one at a time, as required for use by the Indians during the winter.

The ranchmen on Beaver Creek, near Fort Verde, complained that it was very destructive in their corn and grain fields. They destroyed hundreds of them by poisoning, until the air became foul from the stench arising from their decaying bodies.

A number of these troublesome animals took up their residence beneath the post hospital at Fort Verde, whence they made systematic raids on the adjacent quartermaster's storehouse, carrying off barley and corn, to the bewilderment and consternation of the persons who were responsible for the safe-keeping of the forage. My patriotism and public spiritedness never led me to the length of persecuting these mammals for obtaining a share of this provision, a forbearance for which they showed some appreciation by their indifference to my presence, whereas the approach of others was the signal for their instant disappearance under the buildings. A large pile of shingles, left over from reroofing the hospital, and long a bone of contention in the garrison, was neatly piled up in a corner of the hospital yard. This was the favorite rostrum of the ground-squirrels, who sat up erect, with their forepaws hanging down, and chirped a welcome to me as I passed into the hospital at the sounding of surgeon's call in the morning. Their ordinary note is a loud, hollow whistle, which reminds one of the call of the black-headed grosbeak (*Habia melanocephala*), though louder and more penetrating in character; following it, when one is close by, a chipmunk-like chippering is heard, so low as to be inaudible at a short distance.

As one rides among the rocky foothills, this squirrel is frequently seen curled up in the top of a scrub-oak bush, eating acorns or sunning itself and uttering its characteristic note. It loves the sunshine and delights to absorb the warmth and enjoy the scenery from the highest point of some rock pinnacle. The ancient cliff dwellings and ledges in the rocky canyons are its favorite abode. Many of its bones were exhumed from the buildings of the cliff dwellers in the vicinity of Fort Verde.

The "Point of Rocks," near Whipple Barracks, Arizona, is a huge pile of granite rock, of very coarse structure, several miles in extent. It is divided by the canyon of Granite Creek, and furrowed by numerous side canyons and crevices. It contains a number of basins and deep indentures, with many towering points often capped by enormous rounded bowlders, balanced as if in imminent danger of falling. There are a few pines and piñons, some scrub and tall evergreen oaks, together with hackberries and cedars in the ravines, and willows along the stream. These large ground-squirrels were very numerous upon the piles of rounded granite rocks. Those shot there in November were coated with fat, as is the rule at this season. They were swift and graceful climbers, though by no means comparing in this respect with the still more abundant Gila chipmunk (*Eutamias dorsalis*), whose agility and celerity of movement, displayed in running over the rugged rocks, were positively amazing.

Though swift and sure-footed in rocky places, this species immediately loses confidence and seems to become paralyzed by fear when surprised in trees, which, however, it climbs regularly to obtain food.

The season of reproduction, as might be surmised, from the varying conditions of altitude, climate, etc., to which the species is subjected, varies greatly with locality. In the low regions it probably rears more than one litter of young annually. On June 20, 1886, I shot a female at Flagstaff, Arizona (altitude 6,886 feet) that was suckling young. At Fort Verde on March 30, 1887, a rutting male was shot, sporting with a female. On May 6, following, young more than half grown were shot on the summit of Squaw Peak, the highest point near Fort Verde (altitude about 5,500 feet); while young no larger than the eastern red squirrel were taken in the Verde River bottom, 2,000 feet lower, two months later; and a female, shot near Fort Verde on June 14, contained five small fetuses.

The normal individual variation in color is considerable in this species. This variation consists in the relative preponderance of shades of gray, brown and fulvous above, and in the color of the under surface, which varies from soiled white to brown. Examples from the Verde Valley, taken early in June, had shed their coats on the front half of the body, the after parts remaining long haired and of a different color from the front half. Their tails were very scantily haired at that season. Slightly melanistic examples were occasionally seen; and a perfect albino, having colorless claws and pink eyes, was taken alive at Whipple Barracks, Arizona, on September 20, 1887. The latter was a young of the year and died soon after its capture. Males were sometimes taken, though rarely, in which the testicles were abdominal; and, in one specimen, they were wholly absent.

On the United States and Mexican Boundary line this rock-squirrel is found in rocky places in the Eastern Desert Tract. Some were seen at El Paso early in November, 1892. Several were seen at the Upper Corner (Monument No. 40), April and May, 1892. One was shot on the actual summit of Hachita Grande, altitude 2,545 meters or 8,350 feet. Thence westward it was seen in abundance, except in cold weather, to La Osa (Monument No. 140). It was especially abundant in the oak forests of the San Luis and Patagonia mountains, and was sometimes utilized as food by members of the Survey. We saw none while camped at Pozo de Luis, Sonora, from December 29, 1893, to January 8, 1894, but "squirrels" were seen farther west, at Nariz Mountain, by several members of the party, which may have been this species or *Ammospermophilus harrisii*.

In the Dog Mountains one was shot on Emory Peak, and the skin was made into a purse by "Bob," an Apache Indian trailer. Although this species was abundant, no form of *Eutamias* or *Ammospermophilus* was found to inhabit the Dog Mountains.

It was common from the lower timber line to the summit (2,498 meters or 8,196 feet) of the San Luis Range, where it often climbed the tallest oaks for acorns, upon which it loves to feed. A female contained 7 small fetuses, June 23, 1892, and young, from half to two-thirds grown, were taken at the end of September; quite young ones, July 18.

I found it exceedingly numerous on the upper forks of Cajon Bonito Creek in September, 1893. It uttered a startling succession of loudly whistled notes in descending scale and single loud whistles. It was unusually active after rain. It was feeding on mallow, walnut, and oak mast. It often burrowed into the enormous piles of driftage stranded in Cajon Canyon, brought down by the high waters attending cloud-bursts.

On San Jose Mountain, Sonora, where it is abundant, I trapped a specimen August 7, 1893, at the altitude of 2,194 meters or 7,200 feet, and it doubtless reaches the summit.

It was numerous in summer throughout the Huachuca Mountains, where I shot them as late in the year as October 26. Mr. Holzner noted the following: "No. 897 had 4 pairs of mammæ." Of another specimen: "It has a scent opening which it uses like *Spilogale*." Again: "Used its scent bag like *Spilogale* when killed in trap."

In the Patagonia Mountains Mr. Holzner noted its presence in numbers as late as November 14, 1892.

On October 28, 1893, a great many rock-squirrels were seen between Nogales and Tubac. They were feeding upon mesquite beans. The mesquites along this part of the Santa Cruz River were large trees, and I shot two rock-squirrels on the mesquite tops from my horse. Another was seen to enter a burrow at the base of a mesquite tree, from which it had thrown out enough earth to fill a flour barrel.

It is abundant throughout the Pajaritos Mountains; but at La Osa, December 8 to 28, 1893, we seldom saw them, owing to the coldness of the season. Those obtained as specimens were taken in rocky places near oak trees; their cheek-pouches contained seeds of various weeds and mesquite beans. At Warsaw, in the Pajaritos, we found the rock-squirrels still active in November, but during the first week of December they began to disappear. On a warm day I heard a drum-like sound issuing from the desiccated remains of a cow, and on kicking the dry skin a rock-squirrel ran out.

Record and measurements of 60 specimens of Otospermophilus grammurus.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Height of ear above crown.
Skin.	Skull.								
				1884.		*mm.*	*mm.*	*mm.*	*mm.*
[a]2257	In skin.	98	Near Whipple Barracks, Arizona.	May 9	♂ ad.	520	220	55	22
[a]2260	In skin.	119	Fort Verde, Arizona	Aug. 16	[b]♀ ad.	465	205	61	20
				1885.					
[a]2261	1618	221	.....do	July 7	♂ ad.	515	238	60	19
				1886.					
[a]12152		330	.....do	Feb. 18	♂ ad.	448	195	62	18
[a]2262	1643	370	Montezuma Well, Beaver Creek, Arizona.	Apr. 3	♂ ad.	527	247	61	20
[a]2263	1640	371	.....do	..do....	♂ ad.	447	182	55	18
12151	1647	389	Fort Verde, Arizona	Apr. 17	♀ ad.	433	193	56	17
[a].....	1646	390	.....do	Apr. 18	♂ ad.	445	165	55	18

[a] American Museum of Natural History.

[b] Mammæ five pairs.

Record and measurements of 60 specimens of Otospermophilus grammurus—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Height of ear above crown.
Skin.	Skull.								
				1886.		*mm.*	*mm.*	*mm.*	*mm.*
[a]2264	1664	402	Fort Verde, Arizona.............	Apr. 27	♂ ad.	477	215	61	17
......	1641	409	Oak Creek, 35 miles north of Fort Verde, Arizona.	June 14	[b]♀ ad.	470	210	59	.....
[a]2509	1653	423	Flagstaff, Arizona	June 20	♀ ad.	460	180	.....	18
[a]2265	1652	453	Fort Verde, Arizona.............	Aug. 25	♂ ad.	458	223	58	21
[a]2266	1656	457	.....do..........................	Sept. 14	♂ ad.	450	205	62	19
[a]2267	....	463	.....do..........................	Sept. 20	♂ ad.	459	208	59	21
[a]2268	1658	465	.....do..........................	Sept. 24	♀ ad.	438	187	57	22
				1887.					
[a]2269	1881	524	.....do..........................	Mar. 8	♀ ad.	481	206	60	19
......	....	526	.....do..........................	Mar. 30	♂ ad.	480	210	58	19
......	....	527	.....do..........................	Apr. 22	♂ ad.	470	193	61	19
......	....	530	.....do..........................	May 7	♀ ad.	465	200	57	19
[a]2270	1663	531	Rattlesnake Tanks, Flagstaff Road, Arizona.	May 21	♂ ad.	465	190	62	20
[a]2271	1662	578	San Francisco Mountain, Arizona.	June 3	♂ ad.	452	185	60	18
[a]......	1654	622	Natural Bridge, Pine Creek, Arizona.	Aug. 8	♂ ad.	526	211	60	19
[a]......	1659	635	Fort Verde, Arizona.....	Oct. 13	♀ ad.	460	200	58	20
				1888.					
......	....	662	.....do..........................	Apr. 25	♂ ad.	450	195	60	17
......	....	683	.....do..........................	May 14	♂ ad.	470	210	57	20
				1892.					
20542	35701	1908	East side of San Luis Mountains, on Mexican Boundary Line.	June 23	[c]♀ ad.	492	207	60	20
20568	35730	1916	.....do..........................	June 25	♀ ad.	443	185	59	20
20567	....	2004	.....do..........................	June 19	♂ ad.	......	......	......	......
20546	35691	2014	West side of San Luis Mountains, near Mexican Boundary Line.	July 19	♂ ad.	460	207	63	21
20543	35719	2015	.....do..........................	.....do...	♀ ad.	450	198	61	19.5
20547	35696	2016	.....do..........................	July 20	[d]♂ ad.	......	......	59	20
20678	35813	2028	Guadalupe Canyon, Mexican Boundary Line.	July 28	♂ ad.	520	225	63	19
20666	35808	2086	San Bernardino Ranch, at Monument No. 77.	Sept. 3	♀ ad.	475	207	56	18
20738	35838	2107	Bisbee, Arizona	Sept. 16	♀ ad.	485	207	63	17
				1893.					
58908	Missing.	2439	San Jose Mountain, Sonora, Mexico.	Aug. 6	[e]♀ ad.	485	207	60	15
......	36357	2471	Guadalupe Canyon, Mexican Boundary Line.	Aug. 28	[e]♀ ad.	500	225	63	19
58911	58911	2471	.....do..........................	Aug. 29	[e]♀ ad.	495	220	60	18
58909	58909	2502	Turkey Canyon, San Luis Mountains, near Mexican Boundary Line.	Sept. 5	♀ juv.	365	173	......	......
58865	58866	2620	Town of Santa Cruz, Sonora, Mexico.	Oct. 23	♀ ad.	500	230	61	14
58857	58857	2629	Nogales, Monument No. 122.....	Oct. 28	♂ ad.	500	208	62	19
58856	58856	2630	Tumacacori Mission, near Tubac, Arizona.	....do...	♂ ad.	496	223	64	18

[a] American Museum of Natural History.
[b] Contained five fetuses.
[c] Contained seven small fetuses.
[d] Head and body, 280 mm.
[e] Mammæ five pairs.

Record and measurements of 60 specimens of Otospermophilus grammurus—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Height of ear above crown.
Skin.	Skull.								
				1893.		*mm.*	*mm.*	*mm.*	*mm.*
58974	....	2664	Warsaw Mills, Arizona	Nov. 29	♂ im.	463	220	64	19
58975	58975	2667	.....do	Nov. 30	♂ im.	478	235	62	18.5
59221	59221	2720	La Osa, Pima County, Arizona..	Dec. 21	♂ ad.	474	199	62	21
59222	59222	2745	.....do	Dec. 27	♂ ad.	593	218	62	17
				1892.					
20762	35916	803	Patagonia Mountains, Mexican Boundary Line.	Nov. 14	♀ ad.	460	216	60	17
20765	35919	804	.....do	....do ...	♂ juv.	380	181	......	......
20764	35918	821	.....do	Nov. 18	♂ ad.	440	200	62	20.5
20766	35920	825	.....do	Nov. 19	♂ ad.	455	216	63	19
20763	35917	834	.....do	Nov. 21	♀ ad.	442	183	58	17
				1893					
21425	36286	872	Santa Cruz River, at Monument No. 118.	May 29	♂ ad.	511	236	63	17
21426	36287	873	.....do	May 30	♂ ad.	482	228	61	20
58952	58952	882	Huachuca Mountains, Arizona..	July 25	♀ ad.	443	206	60	21
58945	58945	892	.....do	July 31	♂ im.	436	196	59	16.5
58942	58942	897	.....do	Aug. 3	[a]♀ ad.	489	211	62	17
58951	58951	907	.....do	....do ...	♂ ad.	478	205	62	20
58947	58947	926	.....do	Aug. 12	♂.	438	205	59	19
58950	58950	946	.....do	Aug. 16	♂ ad.	494	216	63	18
60036	Alcoholic	955	.....do	Aug. 17	♂ ad.	485	225	61	16.5
58953	58953	1039	.....do	Sept. 20	♂ ad.	480	215	60	17

[a] Mammæ four pairs.

OTOSPERMOPHILUS GRAMMURUS BUCKLEYI (Slack).

TEXAS ROCK-SQUIRREL.

Spermophilus buckleyi SLACK, Proc. Acad. Nat. Sci, Phila., 1861, p. 314 (original description).

Spermophilus grammurus var. *grammurus*, ALLEN, Monogr. N. Am. Rodentia, 1877, p. 827 (part).

Spermophilus grammurus buckleyi, ALLEN, Bull. Am. Mus. Nat. Hist., VIII, 1896, p. 67 (Turtle Creek, Kerr County, Texas).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, no. 1, Dec. 27, 1901, p. 50.

Spermophilus (*Otospermophilus*) *grammurus buckleyi*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 89 (Synop. Mam. N. Am.).

Type-locality.—Pecos River, Texas.

Geographical range.—Sonoran Life Zone of the Middle Texas Tract, its range extending west to the head of the Nueces River, in western Texas.

Description.—Similar in size and form to *Spermophilus grammurus*, but with the anterior half of the dorsal surface black, and the hairs elsewhere with much more black at the tips. Specimens from Kerr County and San Antonio, Texas, lent me from the American Museum collection by Dr. J. A. Allen, have the pelage longer throughout, while the tail, especially, is much more bushy.

Remarks.—To the southward, beyond the Rio Grande, this animal apparently intergrades with *Otospermophilus grammurus couchii*,[a] a wholly black form described by Professor Baird in 1855, from specimens collected by Lieut. D. N. Couch in the Mexican States of Nuevo Leon and Tamaulipas, near the United States and Mexican boundary line.

OTOSPERMOPHILUS BEECHEYI (Richardson).

CALIFORNIA GROUND-SQUIRREL.

Arctomys (Spermophilus) beecheyi Richardson, Fauna Boreali-Americana, I, 1829, p. 170, pl. XII B (original description and figure); Zoology of Beechey's Voyage, Mam., 1839, p. 8.

Arctomys beecheyi, Wagner, Suppl. Schreber's Säugeth., pl. CCXC.

Spermophilus beecheyi, "F. Cuvier, Suppl. Buffon, Mam., I, 1831, p. 331."—Brandt, Bull. Classe Physico-math. Acad. Imp. Sci. St. Petersb., II, 1844, p. 380.—Baird, Proc. Acad. Nat. Sci. Phila., 1855, p. 334; Mam. N. Am., 1857, p. 307, pl. III, fig. 2 (animal); pl. XLVI, fig. 3 (skull).

Sciurus (Macroxus) californicus Lesson, Descr. de Mam. et d'Ois. Nouv., 1847, p. 143.

Spermophilus grammurus var. *beecheyi*, Allen, Proc. Bost. Soc. Nat. Hist., XVI, 1874, p. 293; Monogr. N. Am. Rodentia, 1877, p. 827.

[*Spermophilus grammurus*] *beecheyi*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 88 (Synop. Mam. N. Am.).

Spermophilus grammurus beecheyi, Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, Dec., 1901, p. 50 (Syst. Results Study N. Am. Mam. to close of 1900).

Type-locality.—The neighborhood of San Francisco and Monterey, in California.

Description.—Size smaller than *Otospermophilus grammurus* (nearly as large as the eastern gray squirrel), with a more slender body and shorter tail. Ears high and pointed. Mammæ, six pairs (P. $\frac{2}{2}$, A. $\frac{2}{2}$, I. $\frac{2}{2}=12$). Color above brown, grizzled and annulated with black in a vermicular pattern; darkest anteriorly, and most grizzled and vermiculated posteriorly. Nape and sides of neck silver gray, this color prolonged backward above the shoulder in the form of stripes which are sometimes faintly traceable to the root of the tail, though usually ending about the middle of the body. Ears black outside, grayish or faintly rusty inside, and along posterior border. Top of head bister, slightly dusky above orbits, which are encircled by white. Sides of head grayish, mixed with yellowish brown. The tail which is less bushy and shorter than in *O. grammurus*, is yellowish gray, the lateral hairs thrice annulated with black. Feet yellowish gray. Under surface of body grayish white. The interscapular region is often blackish, more or less vermiculated with pale annuli. Length, 410 mm.; tail vertebræ, 170; hind foot, 55; ear above crown, 21; ear above notch, 27; length of head, 62. Skull, 57 by 34 mm.

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[a] OTOSPERMOPHILUS GRAMMURUS COUCHII (Baird).

NEUVO LEON ROCK-SQUIRREL.

Spermophilus couchii Baird, Proc. Acad. Nat. Sci. Phila., 1855, p. 332.

S[permophilus] grammurus couchii, Allen, Bull. Amer. Mus. Nat. Hist., VIII, p. 68, April 22, 1896.

Spermophilus grammurus couchii, Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, Dec., 1901, p. 50 (Syst. Results Study N. Am. Mam. to close of 1900).

Remarks.—Seventy-one specimens were collected from May 10 to July 13, 1894. The greater portion of these had acquired the summer pelage at the time of capture, though many had not finished the molt. It was observed that those living on the high mountains were latest in molting. Young were being born during the whole of this period. In coloration they closely resemble their parents at the same season. The stripe on the shoulders of this species is an interesting indication of its relationship to the striped ground-squirrels. Some of the specimens, taken near the last monument, had a strong odor resembling vanilla, from digesting vegetable food.

Record and measurements of 31 specimens of Otospermophilus beecheyi.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Height of ear above crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
60897	60897	1964	Mountain Spring, San Diego County, California.	May 10	[a] ♀ ad.	397	157	55	19
60943	60943	1969	.....do	May 13	[a] ♀ ad.	430	167	54	20
60873	60873	1216	.....do	May 10	♀ ad.	402	173	53	19
8284[b]	6620	1220	.....do	May 12	♀.	241	168	54	20
60896	60896	1239	.....do	May 14	♀ ad.	[illegible]	174	52	19
8285[b]	6621	1240	.....do	....do...	♀ ad.	397	159	45	19.5
60944	60944	3538	Jacumba Springs, near Monument No. 233.	May 18	♀ ad.	409	156	54	16
......	63057	3565	.....do	May 22	♂ ad.	......	......	......	......
......	63058	3584	.....do	May 24	[a] ♀ ad.	432	166	55	24
60899	60899	3586	.....do	May 25	♀ ad.	420	177	55	21
61318	61318	3615	Nachoguero Valley, near Monument No. 2.	June 1	♀ ad.	385	158	54	20
61640	Alcoholic	3619	.....do	June 2	♀ ad.	415	167	55	18
......	63060	3620	.....do	....do...	♀ ad.	425	180	51	19
61641	61641	3621	.....do	June 4	♂ ad.	433	178	55	19
......	63061	3628	.....do	June 7	♀ ad.	[illegible]	157	51	18
8286[b]	6622	1391	.....do	June 2	♀ ad.	400	170	53	20
60898	60898	1396	.....do	June 3	♀ ad.	390	163	52	18
60941	60941	1440	Laguna San Diego County, California.	June 12	♀ ad.	405	160	53	20
8289[b]	6625	1449	.....do	June 14	♀ ad.	425	175	55	21
60874	60874	1450	.....do	June 15	♀ ad	412	156	54	20
8290[b]	6626	1451	.....do	....do...	♀ ad.	420	172	53	19
8291[b]	6627	1453	.....do	....do...	[c] ♀ ad.	......	......	56	19
60942	60942	1454	.....do	....do...	♀ ad.	423	177	56	21.5
8292[b]	6628	1468	.....do	June 17	♀ ad.	415	180	55	19

[a] Mammæ 6 pairs. [b] American Museum of Natural History. [c] Head and body, 255 mm.

Record and measurements of 31 specimens of Otospermophilus beecheyi—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Height of ear above crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
61179	61179	3702	San Isidro Ranch, Lower California.	June 28	♀ ad.	400	167	54	19
61182	61182	3719	.....do	June 29	♂ ad.	440	179	56	22
61183	61183	3720	.....do	....do ...	♂ ad.	403	163	55	21
61184	61184	3721	.....do	....do ...	♀ ad.	396	150	53	20
61185	61185	3723	.....do	June 30	♂ ad.	418	168	56	21
60847	60847	3755	.....do	July 2	♂ ad.	403	173	54	20
60848	60848	3789	Edge of Pacific Ocean, at Monument No. 258.	July 13	♂ ad.	420	182	56	21

Genus CITELLUS Oken (1816).

Citellus Oken, Lehrbuch der zoologie, II, 1816, p. 842.—Allen, Bull. Am. Mus. Nat. Hist., XVI, p. 375, Oct. 11, 1902.

Type.—*Mus citellus* Linnæus.

Size medium or small. Form varying from stout or squirrel-like to slender and weasel-like. Tail variable. Cheek-pouches always present, and large. Manus with four well-developed toes and a rudimentary thumb, of which the claw may be either present or absent. Skull lighter than in *Cynomys*, but more strongly built than in *Sciurus* or *Eutamias*, and with the post-orbital processes slender and directed backward and downward; plane of the molar turned outward; zygomatic arches spreading. Upper premolars two, but the first premolar simply rounded and single rooted, never more than about one-third of the size of the second. Character of the pelage and pattern of coloration variable.

Subgenus ICTIDOMYS Allen.

Ears generally small, sometimes rudimentary; tail long, cylindrical, or narrow and flattened, or quite broad, with the hairs one-half to three-fourths the length of the body; skull very long and narrow; first upper premolar usually rather small, and the dentition not heavy. Species, *S. tereticaudus*, *S. mexicanus*, *S. tridecem lineatus*, *S. franklini*. (J. A. Allen.[a])

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[a] Monographs of North American Rodentia, 1877, p. 821. (See Merriam, Science, n. s., II, p. 418, September 27, 1885.)

CITELLUS TRIDECEMLINEATUS TEXENSIS Merriam.

TEXAS THIRTEEN-LINED GROUND-SQUIRREL.

Spermophilus tridecemlineatus texensis MERRIAM, Proc. Biol. Soc. Washington, XII, p. 71, Mar. 24, 1898 (original description).—MILLER and REHN, Proc. Bost. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 56 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Spermophilus tridecemlineatus*] *texensis*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 101. (Synop. Mam. N. Am.)

Type-locality.—Gainesville, Cooke County, Texas. (Type, skin and skull, No. $\frac{3117}{2647}$, collection of Dr. C. Hart Merriam.)

Geographical range.—Lower Austral zone in southern Texas.

The original description of *Citellus tridecemlineatus texensis* reads as follows:

> *Characters*.—Similar to *S. tereticaudus*, but smaller; ground color of upper parts, including base of tail, redder; middle stripe of underside of tail uniform deep reddish, not grizzled with black; no yellowish-olive tinge in any pelage and less seasonal difference in color than in any of the other forms.
>
> *Color*.—*Winter pelage:* Ground color of upper parts, including base of tail, rich deep ferruginous or rusty, slightly grizzled with black hairs; nose grayish, slightly grizzled with rusty; sides of neck, feet, and underparts buffy; head marblings, dorsal stripes and spots, chin and lips buffy-white; rusty underside of tail sometimes partly hidden by buffy tips. *Summer pelage:* Similar to winter pelage, but ground color duller and light stripes and spots more buffy. (Proc. Biol. Soc. Washington, XII, p. 71.)

Remarks.—Dr. J. A. Allen,[a] referring to specimens collected in Bee County, Texas, by Mr. J. M. Priour, observes: "In coloration they are not distinguishable from Minnesota examples."

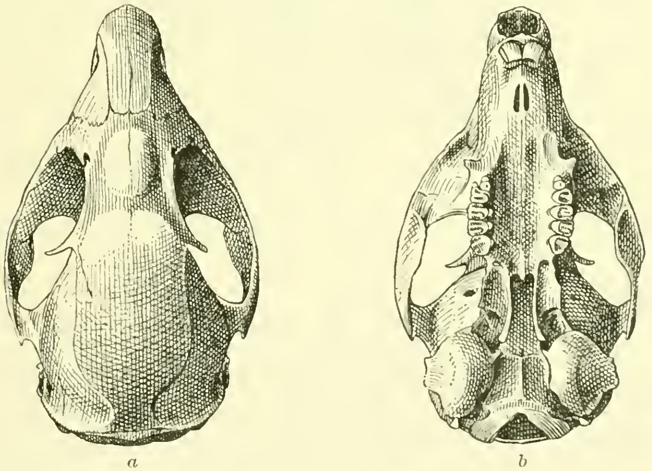

FIG. 50.—CITELLUS TRIDECEMLINEATUS. FORT SNELLING, MINNESOTA. (CAT. NO. 37212, U.S.N.M.) *a*, DORSAL VIEW; *b*, VENTRAL VIEW.

The following description of *S. tridecemlineatus* is based on specimens collected by the writer at Fort Snelling, Minnesota: Size rather large.

---

[a] Bull. Am. Mus. Nat. Hist., III, No. 2, April 29, 1891, p. 223.

Length, 290 mm.; tail, 103; hind foot, 40. The ground color of the upper surface is clove brown, fading with wear to prouts brown; on this there are about eight continuous lines of brownish white, alternating with about seven rows of light spots. Under surfaces, including feet and inner aspect of limbs, clay color. Tail slender, subterete, with the hairs brown at base, banded with black, and tipped with yellowish.

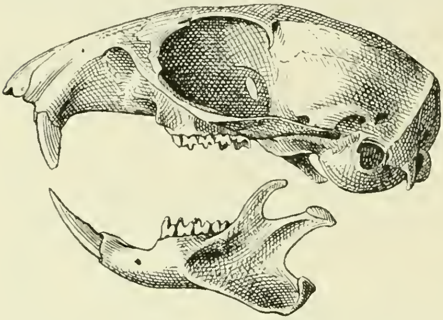

FIG. 51.—CITELLUS TRIDECEMLINEATUS. FORT SNELLING, MINNESOTA. (CAT. NO. 37212, U.S.N.M.)

Cranial and dental characters.—The skull bears a greater resemblance to that of *Tamias striatus* than do those of the other species of the genus, notwithstanding the presence of two upper premolar teeth, the first of which is functionally developed and rather large. Skull elongated, tapering anteriorly, with small audital bullæ, and a long, narrow interpterygoid space. The lateral teeth are not set so obliquely as in *Citellus tereticaudus*. Figs. 50 and 51 show the skull of typical *Citellus tridecemlineatus*.

ICTIDOMOIDES, new subgenus.

Type.—[*Sciurus*] *mexicanus* ERXLEBEN, Syst. Regni Anim., 1, 1777, p. 428 (=*Citellus mexicanus*).

Characters.—Intermediate between *Ictidomys* and *Xerospermophilus*, with tail resembling *Otospermophilus*. Braincase broader than in *Ictidomys*, its breadth, measured at roots of zygomata below, greater than the distance from posterior border of occipital condyle to molar teeth; skull higher in frontal region, with rostrum more depressed, and nasals relatively longer, the internasal suture measuring considerably more than the distance from front premaxilla to anterior premolar; audital bullæ larger. Compared with *Xerospermophilus* these differences are exactly reversed. Color pattern likewise intermediate. Tail three-fourths the length of head and body, somewhat flattened, and bushy.

CITELLUS MEXICANUS PARVIDENS (Mearns).

RIO GRANDE GROUND-SQUIRREL; SMALL-TOOTHED GROUND-SQUIRREL.

Spermophilus mexicanus parvidens MEARNS, Proc. U. S. Nat. Mus., XVIII, p. 443, May 23, 1896 (advance sheet published March 25, 1896; original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 52 (Syst. Results Study N. Am. Mam. to close of 1900).

Spermophilus mexicanus, BAIRD, Mam. N. Am., 1857, p. 319; U. S. and Mex. Bound. Surv., II, Pt. 2, Mam., 1859, p. 39.—ALLEN, Proc. Bost. Soc. Nat. Hist., XVI, 1874, p. 291 (in part); Monogr. N. Am. Rodentia, 1877, p. 868 (in part); Bull. Am. N. Am. Mus. Nat. Hist., III, No. 2, 1891, p. 223 (Texas and Tamaulipas); VI, 1894, p. 182 (Texas).

[*Spermophilus mexicanus*] *parvidens*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 99 (Synop. Mam. N. Am.).

[*Citellus mexicanus*] *parvidens*, Elliot, Field Col. Mus., Zool. Ser., IV, 1904, p. 146 (Mam. of Mid. Am.).

Type-locality.—Fort Clark, Kinney County, Texas. (Type, skin and skull (fig. 52), No. 63073, U.S.N.M.)

Geographical range.—Tamaulipan Fauna of Texas and Mexico. Found on the Rio Grande from the mouth of the Devils River to Brownsville and north along the Gulf coast to Corpus Christi.

Description.—Size larger than a *Xerospermophilus*, but smaller than *Citellus mexicanus* Erxleben; pattern similar; colors paler, with under surfaces white, not washed with yellowish brown; tail bushier, its hairs with two instead of three black annuli, and grayish instead of yellowish tips. Above, with about nine obscure and interrupted white stripes on an olivaceous-gray ground. Tail flattened and bushy, except at the base, which is cylindrical; color grayish white, mixed with black, the lateral hairs twice banded with black, the outer band twice as wide as the inner. Ear-conch short. Head hoary grayish, with end of nose yellowish and orbital ring white. Under surfaces white. Iris hazel.

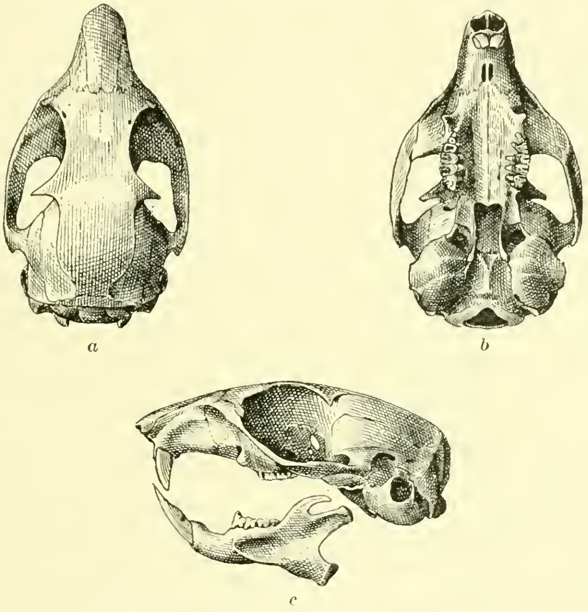

Fig. 52.—Citellus mexicanus parvidens. (Type, Cat. No. 63073, U.S.N.M.)
a, Dorsal view; *b*, Ventral view; *c*, Lateral view.

Specimens from the Gulf coast are yellower and more heavily colored than those from Kinney County, Texas.

Record and measurements of 18 specimens of Citellus mexicanus parvidens.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Height of ear above crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
63073	63073	2312	Fort Clark, Kinney County, Texas	Mar. 21	[a] ♂ ad.	325	130	44	3.5
63074	63074	2313	do	do	[b] ♀ ad.	......	......	42	3.5
114651	114651	2315	do	Mar. 27	♂ ad.	303	125	39	4
63075	63075	2321	do	Apr. 15	♂ ad.	310	118	41	4.5
63076	63076	2329	do	Apr. 24	♀ ad.	303	124	40	3.8
63077	63077	2332	do	May 18	[c] ♂ ad.	......	......	42	4.5
				1898.					
84603	84603	4303	do	Mar. 19	♀ ad.	258	107	38	......
84830	Alcoholic	4364	do	Apr. 11	♂ ad.	......	......	......	......
84625	84625	4367	do	Apr. 12	♂ ad.	......	......	......	......
84626	84626	4368	do	do	♂ ad.	......	......	......	......
84627	84627	4369	do	do	♀ ad.	......	......	......	......
84831	Alcoholic	4370	do	Apr. 13	♀ ad.	......	......	......	......
111628	111628	[d] 44	do	June 3	♂ ad.	302	123	40	4
111629	111629	[d] 45	do	do	♀ ad.	290	124	39	4
111630	111630	[d] 46	do	June 4	♀ im.	280	105	38	4
111631	111631	[d] 47	do	do	♂ ad.	300	95	42	4
111632	111632	[d] 48	do	June 6	♀ im.	272	106	36	4
111633	111633	[d] 49	do	do	♂ ad.	......	......	41	4

[a] Iris hazel. *Type.*
[b] Head and body, 180 mm.
[c] Head and body, 143 mm.
[d] Collected by Louis di Zerega Mearns.

Subgenus XEROSPERMOPHILUS Merriam.

Xerospermophilus MERRIAM, Proc. Biol. Soc. Washington, VII, p. 27, Apr. 13, 1893 (original description).—ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 95 (Synop. Mam. N. Am.); IV, 1904, p. 143, fig. 25 (Mam. Mid. Am.).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901 p. 46, footnote (Syst. Results Study N. Am. Mam. to close of 1900).

Characters.—Small-sized, slender ground-squirrels, usually having the tail less than half the length of the head and body. Skull short, broad, and highly arched; broad interorbitally; rostrum short; nasals broad; audital bullæ very large; and postpalatal notch long and narrow.

CITELLUS SPILOSOMA ARENS (Bailey).[a]

EL PASO SPOTTED GROUND-SQUIRREL.

Spermophilus spilosoma arens BAILEY, Proc. Biol. Soc. Washington, XV, p. 118, June 2, 1902 (original description).

Citellus spilosoma arens MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXXI, No. 3, Aug. 27, 1903, p. 75 (Syst. Results Study N. Am. Mam. during the years 1901 and 1902).

Taza (gopher) or *Uron* (officer) of the Mexicans.

Geographical range.—Sonoran Zone, in southwestern Texas and the adjacent parts of Mexico—the Eastern Desert Tract.

Description.—Size small; form slender. Tail terete at base, somewhat flattened and bushy at extremity. Feet (fig. 53) small. Ears reduced to short rims. Length, 240 mm.; tail vertebræ, 80 (to end of hairs, 100); hind foot, 35; head, 43. Skull, 39 by 23.5. Mammæ, 5 pairs. Iris hazel. Dichromatic, with reddish and grayish color-phases. Pattern spotted above, with ill-defined white spots arranged in longitudinal series. Ground color nearly uniform vinaceous-cinnamon, or rusty brownish gray, according to the phase of coloration. Under surface and sides of head, except a longitudinal infraorbital stripe, white. Tail vinaceous-cinnamon above, except at the tip, where the hairs are broadly banded with black and tipped with yellow; under surface of tail yellow.

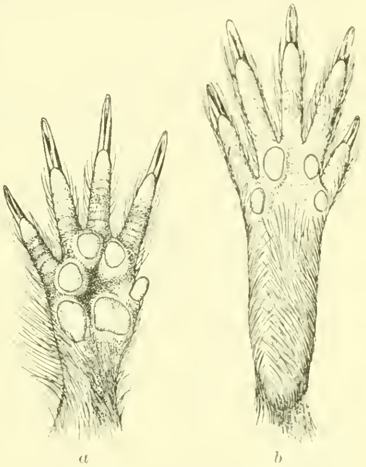

FIG. 53.—CITELLUS SPILOSOMA ARENS. FORT HANCOCK, TEXAS. (CAT. NO. 63385, U. S. N. M.) *a*, FOREFOOT; *b*, HINDFOOT.

Cranial and dental characters.—Those of the subgenus *Xerospermophilus*, constituted by Doctor Merriam for the reception of the *spilosoma* group, of which *Citellus mohavensis* (Merriam) is the type. Skull with shortened rostrum, broad nasals, narrow interpterygoid space, sharply elevated supraorbital rim, and heavy, obliquely-set teeth. The first upper premolar is much larger than in *Ammospermophilus*, and about as in *Citellus tereticaudus*.

Remarks.—The hair is short and coarse at all seasons. In winter there is some under fur, and the under surfaces are well covered; but in summer the hair is remarkably short and coarse, scarcely covering the skin of the ventral surface. In a few specimens, taken at this season, the white spots are wanting, the upper surface being vinaceous-cinnamon, with a few black hairs, and a finer sprinkling of white, from hoary tips or annuli to the hairs.

---

[a] The subspecific name *spilosoma* was restricted by Merriam (N. Am. Fauna, No. 4, p. 37, Oct. 8, 1890) to the animal occurring in northern Mexico and extreme western Texas. In describing "*Spermophilus spilosoma marginatus*," a new subspecies, from Alpine, Texas, Mr. Bailey says that it is "Similar to the dark, typical form of *spilosoma* from northeastern Mexico, but smaller and brighter colored," the inference being that he has refixed the type-locality of *Citellus spilosoma spilosoma* to "northeastern Mexico."

Habits and local distribution.—At Fort Hancock, on the Rio Grande, in the Eastern Desert Tract, this ground-squirrel was extremely abundant. Many of those trapped in June, 1893, were found completely cooked by solar heat—to such an extent that they fell from the trap in pieces when lifted from the hot sand, where they had been exposed to the sun's heat but a few hours. In February and March, 1892, we found it abundant at El Paso and at old Fort Bliss, Texas. It was found at every camp east of the San Luis Mountains, excepting Big Hatchet Mountain. It was common at the altitude of 1,600 meters, below timber line, on the east side of the San Luis Mountains.

CITELLUS SPILOSOMA ANNECTENS (Merriam).

PADRE ISLAND GROUND-SQUIRREL.

Spermophilus spilosoma annectens Merriam, Proc. Biol. Soc. Wash., VIII, pp. 132, 133, Dec. 28, 1893 (original description).—Allen, Bull. Am. Mus. Nat. Hist., VI, Art. VI, May 31, 1894, pp. 182, 183 (Mustang Island, Texas).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 54 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Spermophilus spilosoma*] *annectans*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 97 (Synop. Mam. N. Am.).

Type-locality.—Padre Island, Cameron County, Texas. (Type, skin and skull, No. $\frac{30410}{42396}$, U. S. National Museum, Biological Survey Collection.

Geographical range.—Southern coast region of Texas (Padre Island, Mustang Island, and adjacent mainland).

The original description is as follows:

> *General characters.*—*S. annectens* is about the size of *S. spilosoma major*, which it resembles in coloration and markings, though the pelage has a grayish cast, suggesting *S. obsoletus*. Ear a mere rim, about 3 mm. high at highest point.
>
> *Color.*—Upper parts dull grayish brown; back beset with ill-defined buffy spots, margined posteriorly with dusky in unworn pelage; underparts soiled white. Eyelids white. Tail concolor with back or a little more fulvous, its distal half or two-thirds bordered with a subapical black band, beyond which the tips of the hairs are buffy ochraceous. Immature specimens and young of the year are more brownish than the adults and show the spots much more distinctly, as usual in the *spilosoma* group.
>
> *Cranial and dental characters.*—Compared with *S. spilosoma major*, the skull of *S. annectens* is longer, but is actually as well as relatively narrower across the zygomatic arches, particularly anteriorly, where the anterior roots are pinched in as in *Ictidomys;* frontals broader interorbitally; fronto-nasal region more convex; supraorbital foramina usually completely inclosed; postorbital processes more strongly decurved; audital bullæ smaller; postzygomatic notch almost obsolete; rostrum broader across

the base, with the lateral angle less marked. Under jaw larger and heavier, with posterior edge of inflected angular process broader, shorter, and less transverse. The cranium as a whole is narrower and higher than in any known member of the subgenus *Xerospermophilus.*

The dentition is unusually heavy for the subgenus, and the crown of the last upper molar is about as long antero-posteriorly as transversely. The first upper premolar is about one-third the size of the second. In all of these respects, except the character of the angular process of the mandible, the cranial peculiarities of *S. annectens* depart from the *S. spilosoma* type and resemble the *S. mexicana* type.

General remarks.—Fourteen specimens of this animal are in the [U. S.] Department [of Agriculture] collection, thirteen from Padre Island, Texas, and one from the mainland at the mouth of the Rio Grande. Padre Island is a long spit of sand in the Gulf of Mexico, just north of the mouth of the Rio Grande. (Proc. Biol. Soc. Washington, VIII, pp. 132, 133.)

CITELLUS SPILOSOMA MACROSPILOTUS (Merriam).

APACHE GROUND-SQUIRREL.

Spermophilus spilosoma macrospilotus Merriam, North American Fauna, No. 4, Oct. 8, 1890, p. 38 (original description; normal or reddish phase, from Oracle, Pinal County, Arizona).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 55 (Syst. Results Study N. Am. Mam. to close of 1900).

Spermophilus canescens Merriam, North American Fauna, No. 4, Oct. 8, 1890, p. 38 (grayish phase, from Willcox, Cochise County, Arizona).

Spermophilus (*Xerospermophilus*) *microspilotus*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, fig. 21 (Synop. Mam. N. Am.).

[*Spermophilus spilosoma*] *microspilotus*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 96 (Synop. Mam. N. Am.).

Citellus (*Xerospermophilus*) *s. microspilotus*, Elliot, Field Col. Mus., Zool. Ser., IV, 1904, pp. 144, 145, fig. 25 (Mam. Mid. Am.).

Type-locality.—Oracle, Pinal County, Arizona. (Type, skin and skull, No. $\frac{16750}{23663}$ in the U. S. National Museum, Biological Survey Collection).

Geographical range.—Sonoran Zone, in the Elevated Central Tract.

Description.—Much darker and more strongly colored than the typical form of the Eastern Desert Tract. Length, 220 mm.; tail vertebræ, 75 (to end of hairs, 95); hind foot, 30. Skull, 35 by 22. Mammae, five pairs. Ground color russet-brown, mixed with a few light-tipped hairs. Spots large, roundish, and far apart. Tail concolor with the body on its proximal half; yellow, ringed with black, on terminal half; and yellow beneath. Feet and under surfaces white. Skull (fig. 54) apparently smaller and relatively broader than in the typical form.

The gray phase, "*Spermophilus canescens*," is described by Doctor Merriam as follows:

> *Color.*—Upper parts drab-gray, much obscured by hoary; head and face hoary; back everywhere covered with transversely elongated whitish markings, which are much crowded and tend to run together laterally, forming transverse wavy bars, separated by narrower dark wavy lines, consisting of the dark tips of the hairs. Eyelids and

underparts white. Tail above, grizzled grayish drab, mixed with blackish on the terminal third and bordered with buffy; tail below, buffy with a submarginal blackish band. (North American Fauna, No. 4, p. 38.)

Habits and local distribution.—I first saw the Apache ground-squirrel between Mountain Spring and the San Pedro River at Tres Alamos, April 8, 1885. A week later I met with it between Lordsburg, New Mexico, and Alkali Flat to the westward, when crossing a series of ridges covered rather scantily with the creosote bush (*Covillea tridentata*), where the burrows of this species were abundant, and the animals themselves often seen and heard. It was abundant April 18 to 24, 1885, at Deming, New Mexico, living under mesquites. While marching from Lordsburg to Steins Pass, April 27, 1885, we found this ground-squirrel abundant, and its lisping whistle was continually heard as we passed by. The young were often seen during our march from Steins Pass, New Mexico, to San Simon, Arizona, April 28, 1885; and the animal was also observed on the plain east of Dragoon Summit, on the Southern Pacific Railroad, Arizona.

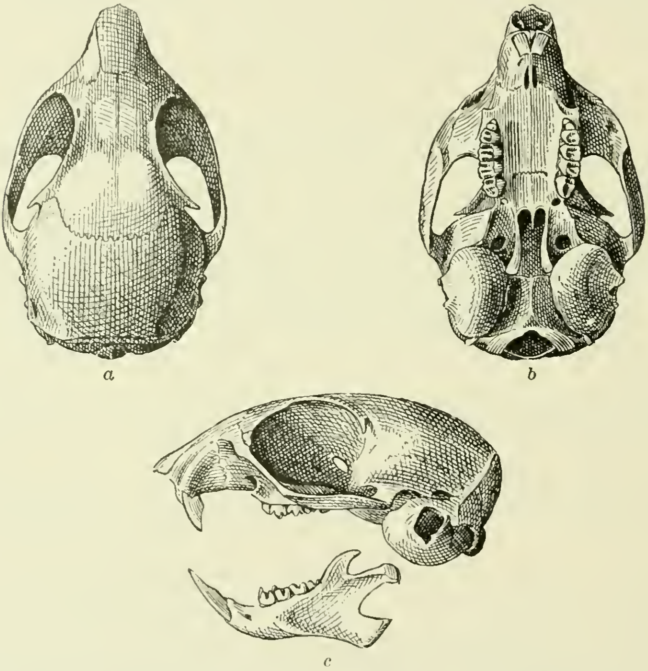

FIG. 51.—CITELLUS SPILOSOMA MACROSPILOTUS. LA NORIA, SONORA, NEAR MONUMENT NO. 112. (CAT. NO. 35870, U.S.N.M.) *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

In following the Mexican Boundary Line we never found this ground-squirrel abundant except on the days when we crossed the San Simon Valley. There it was continually seen running from one creosote bush to another.

Measurements of 31 specimens of Citellus spilosoma arens, annectens, and macrospilotus.

Museum number. Skin.	Museum number. Skull.	Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind foot.	Height of ear rim.
			Citellus spilosoma arens.	1893.		*mm.*	*mm.*	*mm.*	*mm.*
21041	36083	2339	Fort Hancock, El Paso County, Texas.	June 15	[a] ♀ ad.	240	80	36.5	4
21049	36082	2357	.....do	June 23	[b] ♀ ad.	230	74	37	4.3
21033	36075	2364	.....do	June 24	♂ ad.	225	75	37.5	4
21036	36078	2365	.....do	....do...	[c] ♀ ad.	247	87	35	3.6
21034	36076	2370	.....do	June 25	[d] ♀ ad.	237	80	37	3
21038	36080	2374	.....do	June 26	♀ ad.	250	85	37.5	3
21039	36081	2400	.....do	....do...	♀ ad.	233	73	36	3
21032	36074	2403	.....do	June 28	[e] ♀ ad.	254	88	35	3
21035	36077	2407	.....do	June 29	♂ ad.	240	82	35	3
21037	36079	2408	.....do	....do...	♂ ad.	221	64	36.5	3
				1892.					
20090	37043	1428	El Paso, Texas	Feb. 9	[f] ♀ ad.	232	82	36	......
20089	35457	1477	.....do	Feb. 20	♂ ad.	226	71	37	3
20091	35458	1489	.....do	Feb. 21	♂ ad.	225	74	34	......
20308	35544	1560	Monument No. 15	Mar. 21	♂ ad.	235	85	35	......
20304	35560	1601	.....do	Mar. 29	♂ ad.	203	65	32	......
21316	37044	1616	.....do	Apr. 1	♀ ad.	213	66	34	3
20307	35584	1643	.....do	Apr. 6	♀ ad.	219	70	36	4
20306	35613	1656	Palomas Lakes, Chihuahua, Mexico	Apr. 12	♂ ad.	235	84	36	......
20305	35608	1686	Monument No. 40	Apr. 24	♀ ad.	207	72	33	4
20303	35597	1687	.....do	....do...	♀ ad.	223	72	35	3.5
21334	37045	1707	.....do	Apr. 27	[g] ♂ ad.	......	......	34	4
20510	35913	1774	Dog Spring, Grant County, New Mexico.	May 23	♀ ad.	219	67	34	4
21317	37046	1792	.....do	May 28	♀ ad.	229	78	35	3
20511	35914	1827	.....do	June 2	[h] ♂ ad.	......	......	32	3
20740	37047	1842	.....do	June 3	[i] ♂ ad.	....	.....	35	3.5
20509	35741	1861	.....do	June 9	♂ ad.	227	69	35	3.5
20512	35738	1868	.....do	June 10	[k] ♂ ad.	......	.....	36	4
				1893.					
21477	36304	2542	.....do	Sept. 19	♀ juv.	203	73	......	......
				1892.					
20677	37048	1877	White Water, Chihuahua, Mexico.	June 16	♀ ad.	215	75	32	3.5
			Citellus spilosoma annectens.	1891.					
30410	12396	691	....	Aug. 24	♂ ad.	230	60	38	3
			Citellus spilosoma macrospilotus.	1892.					
20725	35870	838	La Noria, Santa Cruz River, near Monument No. 112	Nov. 25	♀ juv.	202	70	28	2

[a] Contained 7 small fetuses; mammæ, 5 pairs, iris, hazel.
[b] Contained 6 very small fetuses. Iris, hazel.
[c] Mammæ, 5 pairs.
[d] Mammæ, 5 pairs; contained milk.
[e] Mammæ, 5 pairs, not pregnant, very fat.
[f] Had suckled young.
[g] Head and body, 163 mm.
[h] Tail deformed.
[i] Rutting. Head and body, 165 mm.
[k] Head and body, 165 mm.

CITELLUS TERETICAUDUS (Baird).

YUMA GROUND-SQUIRREL.

Spermophilus tereticaudus BAIRD, Mam. N. Am., 1857, p. 315 (original description); Rep. U. S. Mex. Bound. Surv., II, Pt. 2, Mam., 1859, p. 38, pl. VII, fig. 2 (head and feet); pl. XXII, fig. 4 (skull).—ALLEN, Proc. Bost. Soc. Nat. Hist., XVI, 1874, p. 291.—TRUE, Proc. U. S. Nat. Mus., VII, 1885, p. 594.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901 (Syst. Results Study N. Am. Mam. to close of 1900).

Spermophilus (*Ictidomys*) *tereticaudus*, MEARNS, Bull. Am. Mus. Nat. Hist., I, No. 7, July, 1886, pp. 197–207 (Arizona).

[*Spermophilus* (*Xerospermophilus*)] *tereticaudus*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 98 (Synop. Mam. N. Am.).

[*Citellus* (*Xerospermophilus*)] *tereticaudus*, ELLIOT, Field Col. Mus., Zool. Ser., IV, 1904, p. 144 (Mam. Mid. Am.).

Type-locality.—Old Fort Yuma, San Diego County, California (on the right bank of the Colorado River, opposite the mouth of the Gila River and the present town of Yuma, Arizona). (Type, skin and skull, No. $\frac{1584}{2419}$, U. S. National Museum).

Geographical range.—Lower Sonoran Zone of the Western Desert Tract: from Fort Lowell and La Osa on the east to the Coast Range Mountains on the west.

Description.—Size small. Length, 250 mm.; tail vertebræ, 97; hind foot, 36; ear rim, 3; head, 42. Skull 38 by 24. Form slender; head short; ear reduced to a mere rim; tail cylindrical, with hairs appressed. There are 5 pairs of mammary teats (in one case, six pairs). Iris dark brown. Claws purplish black, tipped with horn color. Color in winter pinkish buff above, with some hoariness, white below; tail concolor with the body above, yellower below, and obscurely annulated; feet white; pelage fine, with copious under fur which is plumbeous at base and white at tip. In summer vinaceous-buff above, mixed with a few black and a few white pointed hairs; pelage short and coarse, without under fur, and not concealing the skin below. In coloration, the young closely resemble their parents.

Cranial and dental characters.—Skull (fig. 55) short, broad, broadly arched interorbitally; rostrum abbreviated; audital bullæ large, deep, and very evidently lobed by deep vascular channels; interpterygoid fossa narrow; malar arches very strong and much everted. Dentition strong; lateral rows of teeth approximated posteriorly, with the molars set very obliquely.

Remarks.—Molting begins in March. Nursing females taken on the Colorado Desert during the last week of April and first week in May were all in summer pelage—except the tail, the last part to change. Specimens from the Tule and Yuma deserts, to the eastward of the Colorado River, are more reddish than those taken at the same season on the western part of the Colorado Desert. The same is true of the other mammals living in those regions.

Habits and local distribution.—In 1885, when marching with the Third Cavalry toward Texas from Fort Verde, Arizona, I first met with the Yuma ground-squirrel—then only known from the specimens collected by Maj. (afterwards Maj. Gen.) George H. Thomas, near Halls Station on New River, just within the northern limit of Maricopa County, Arizona. I saw them every day of our march until we arrived at Mountain Springs, a day's march east of Tucson. From this point eastward to Deming, New Mexico, I mistook *Citellus spilosoma macrospilotus* for this species, and embrace this occasion to rectify my previous erroneous record of the existence of the Yuma ground-squirrel in southeastern Arizona and at Deming, New Mexico. On October 17, 1884, I saw some Yuma ground-squirrels among the mesquites on the San Carlos flats at the Indian Agency on the Gila River.

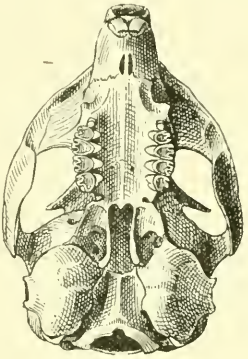

FIG. 55.—CITELLUS TERETICAUDUS. QUITOBAQUITA, ARIZONA. (CAT. NO. 59888, U.S.N.M.)

Near the Mexican Boundary this species is abundant from the Santa Cruz Valley, Arizona, to the Coast Range Mountains of California. From January 25 to February 8, 1894, it only appeared on the warmest days in places on both sides of the Boundary where it is common. Our first specimens were caught at Quitobaquita; they were not out of their burrows in the region to the eastward, during the cold season of our visit. It appeared to be scarce in February on the plains immediately surrounding the Gila Mountains, but was common at Adonde Siding on the Gila River, and less so at Gila city, on the Gila, 15 miles above Yuma, Arizona. It was abundant along the Gila from Gila city to Yuma, and down the Colorado River to the Gulf of California. It was common, though generally not abundant, along the Salton and New rivers to the Boundary Line and thence west as far as Coyote Wells. It was most abundant at Indian Wells on the New River. No other ground-squirrel was found on the open desert; but *Ammospermophilus leucurus* (Merriam) appeared as soon as the Coast Range was reached. Dr. W J McGee has written that ground-squirrels are "common" in Seriland, western Sonora, Mexico, a remark that may apply to this species.[a]

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[a] *Spermophilus sonoriensis* Ward, described (Am. Nat., XXV, Feb. 1891, p. 158) from Hermosillo, State of Sonora, Mexico, is regarded by Merriam and Elliot as a race of *Citellus tereticaudus*.

Measurements of 28 specimens of Citellus tereticaudus.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Height of ear rim.
Skin.	Skull.								
				1885.		*mm.*	*mm.*	*mm.*	*mm.*
2272[a]	1845	168	Near Hall's ranch, New River, Arizona.	Mar. 28	♀ ad.	247	74	35	4
12160[a]	1851	169	Between New River and Phoenix, Arizona.	....do...	♂ ad.	250	85	36	3
12159[a]	1846	170	....do	....do...	♀ ad.	232	72	33	4
2273[a]	1848	171	Between New River and Desert Station, Arizona.	....do...	♂ ad.	239	73	34	3
2274[a]	In skin.	172	....do	....do...	♂ ad.	240	85	35	4
2275[a]	1850	174	Near Maricopa, Arizona	Mar. 30	♀ ad.	237	77	34	3
2276[a]	1847	195	Desert Station, Arizona	May 25	[b] ♂ ad.	......	......	37	3
				1894.					
61526	Alcoholic.	2828	Quitobaquita, Monument No. 172.	Jan. 25	♂ ad.	253	100	36	3
59888	59888	2832	....do	....do...	♂ ad.	229	80	31	3
59890	59890	2838	....do	Jan. 26	♂ ad.	248	86	37	3
59891	59891	2850	....do	Jan. 29	♂	242	87	37	3
59889	59889	2874	....do	Jan. 31	♂ ad.	260	99	38	3
59892	Missing.	3033	Tinajas Altas, Yuma County, Arizona.	Feb. 23	[c] ♂ ad.	......	......	35	......
59885	Missing.	3041	Adonde, Yuma County, Arizona	Feb. 25	♂ ad.	235	88	38	3
59884	Missing.	3054	....do	Feb. 26	♂ ad	238	82	35	3
59886	Missing.	3055	....do	....do...	♂ ad.	250	84	37	3
60336	60336	3106	Yuma, Arizona	Mar. 9	♂ ad.	211	63	34	......
60333	60333	3107	....do	....do...	♂ ad.	239	90	37	......
60332	60332	3162	Yuma Desert, Monument No. 200.	Mar. 16	♀ ad.	238	92	37	3
60329	60329	3196	Colorado River, at Monument No. 204.	Mar. 17	♂ ad.	255	97	37	3
60337	60337	3197	....do	....do...	♂ ad.	233	85	36	3
60327	60327	3198	....do	....do...	♂ ad.	239	90	35	3
60326	60326	3199	....do	....do...	♀ ad.	......	......	......	......
60323	60323	3200	....do	....do...	♀ ad.	238	95	36	3
60325	60325	3223	....do	Mar. 18	♀ ad.	250	101	36	3
60335	60335	3361	Cienega Well, 30 miles south of Monument No. 204.	Mar. 23	♀ ad.	220	92	37	3
61168	61168	3497	Gardners Laguna, Lower California.	Apr. 26	[d] ♀ ad.	262	99	36	3
61169	61169	3504	Indian Well, New River, San Diego County, California.	May 3	♀ ad.	249	96	37	3
8293[a]	6629	1126	Seven Wells, Lower California.	Apr. 10	[e] ♀ ad.	269	106	36	3

[a] American Museum of Natural History

[b] Tail defective.

[c] Head and body, 151 mm.

[d] Mammæ, 5 pairs.

[e] Mammæ, 6 pairs, contained five fetuses.

Subfamily MARMOTINÆ.

MARMOTS.

Incisors not compressed; typically, the form stout and the tail comparatively short. This subfamily comprises burrowing forms which may be collectively known as "marmots;" as already mentioned, they are so intimately connected with the preceding subfamily (*Sciurinæ*) that the division into two groups is purely a matter of convenience. They are confined to the Palæarctic and Nearctic regions. (*Flower and Lydekker.*)

Genus CYNOMYS Rafinesque (1817).

Five distinct claws to each foot, that on the thumb as large as that on the fifth toe. Cheek-pouches shallow. Ear-conchs small. Tail short. Skull stout, with postorbital process strongly developed and directed outward. Dentition as shown in fig. 56. First premolar nearly as large as the second. Lateral rows of teeth strongly convergent posteriorly and twisted on their axis. Incisor teeth white or but slightly colored. Mammæ, four or five pairs. Form stout and muscular.

Two species of this genus inhabit the region of the Mexican Border. Their ranges are complementary, *Cynomys ludovicianus arizonensis* being an inhabitant of the Sonoran Life Zone, on both sides of the International Line, while *C. gunnisoni* is restricted to the Transition Zone, its range to the southward falling short of the Mexican Boundary.

CYNOMYS LUDOVICIANUS ARIZONENSIS (Mearns).

ARIZONA PRAIRIE-DOG.

Cynomys arizonensis MEARNS, Bull. Am. Mus. Nat Hist., II, No. 4, Feb. 21, 1890, p. 305 (original description).—ALLEN, Bull. Am. Mus. Nat. Hist., VII, 1895, p. 237.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 57 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Cynomys*] *arizonensis*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901 (Synop. Mam. N. Am.); IV, 1904, p. 154 (Mam. Mid. Am.).

Cynomys ludovicianus arizonensis, MERRIAM, Proc. Biol. Soc. Wash., VII. p. 158, July 27, 1892.

Type-locality.—Point of Mountain, near Willcox, Cochise County. Arizona. (Type, No. $\frac{12162}{2509}$. American Museum of Natural History. New York.)

Geographical range.—Grassy plains of the Sonoran Zone, from the Pecos River, Texas, west to the valley of the San Pedro River, Arizona.

Description.—Largest of the prairie-dogs found in the United States.[a] Length, 400 mm.; tail vertebræ, 90; hind foot, 64; head, 73. Skull, 66 by 45; incisors white or slightly colored. Mammæ 4 pairs (A $\frac{1}{1}$, P. $\frac{1}{1}$, A. $\frac{1}{1}$, I. $\frac{1}{1}$). In winter the pelage of the upper surface is pale sandy buff, with a few all-black and many gray-tipped hairs; under surface white or pale yellowish; sides yellow; tail with a narrow, subterminal bar of black; under side of tail and inguinal region tawny ochraceous; underfur copious. In summer the underfur is wanting; color vinaceous cinnamon above, with but few black hairs and grizzling obsolete; below whitish; sides yellowish. Iris hazel.

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[a] The *Cynomys mexicanus* of Merriam, from La Ventura, Coahuila, Mexico, is about the same size, but has a much longer tail.

Seasonal changes.—There are two seasonal pelages, winter and summer, the latter worn only for a few weeks. The winter overhair falls out at the beginning of hot weather, leaving the animal clad in its winter underfur, which soon becomes brittle and worn, exposing the dark color at base, when the animal looks ragged and patchy, often appearing to be blackish when seen at a distance. The summer pelage is first acquired on the forefeet and head, extends slowly backward over the shoulders, but rapidly over the ventral surface and inner sides of the hind limbs, then to their outer surface, and lastly to the rump and tail. The underfur disappears at the advent of the coarse summer coat, in which it is wanting. The change from winter to summer dress is a slow one, that from summer to winter much

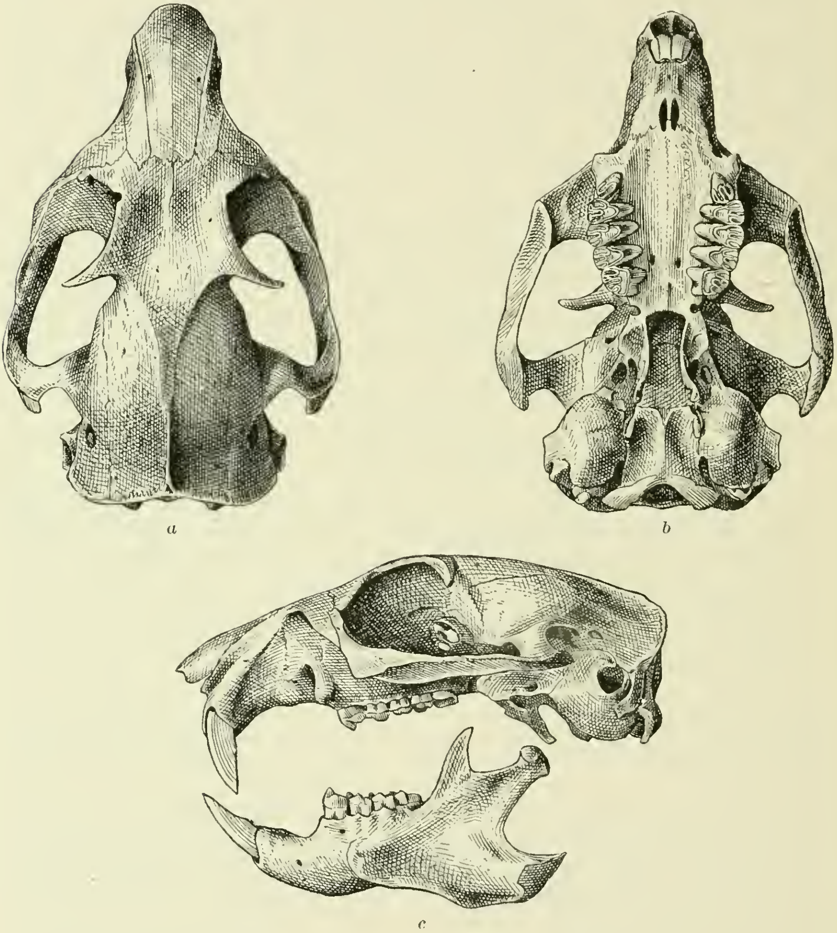

FIG. 56.—CYNOMYS LUDOVICIANUS ARIZONENSIS. (CAT. NO. 36362, U.S.N.M.) *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

more rapid. As pointed out by Dr. J. A. Allen[a] in the case of the red squirrel (*Sciurus hudsonicus*) and chipmunks (genus *Eutamias*), the sequence of the autumnal change of pelage is just the reverse of what occurs during the vernal molt, the tail being the first part to receive the winter coating and the head and feet the last. Lactation appears to exert some influence in retarding the molt, but this is less marked in the South than the North, where parturition bears a more definite relation to season and temperature.

Specimens taken at El Paso, Texas, February 7, were in complete winter pelage. The species was next met with at Dog Spring, Grant County, New Mexico, where nine specimens, taken during the last week of May, were in mixed winter and summer pelage. The males and virgin females had, with one exception, received the summer pelage except on the tail. Nursing females were in summer pelage anteriorly, and posteriorly the overhair had fallen out, leaving the underfur exposed. Six specimens, from the Animas Valley, which has a considerably higher altitude than Dog Springs, taken June 29, are no further advanced than the Dog Springs series, killed a month earlier, none of the males having completed the summer molt. Not one of eleven specimens taken during the last week of July, on the San Pedro River at Monument No. 98, had received the whole summer coat, although several were almost in summer pelage. Of four females, taken June 19, at Belen, Texas, the lowest point at which the species was collected, three are entirely in summer pelage and the fourth nearly so. A female, taken July 5 in the Animas Valley near Monument No. 66, had not quite completed the summer pelage; but two males, from Cloverdale, on the opposite side of the same valley, taken July 15, were in perfect summer dress.

Eight specimens from the Animas Valley, taken by the writer, August 31 to October 2, 1893, show the whole progress of the autumnal molt very satisfactorily. Specimen No. 58915, U.S.N.M., has molted the summer hair on the tail, which is coated with winter hair. The body still retains the summer hair, but on parting this short, scant coat, the new winter hair, copiously mixed with underfur, may be seen sprouting. The other two specimens of the same date are somewhat further advanced. In four September specimens, the winter coat has extended forward as far as the head above, and is appearing on the under surface of the body. Specimen No. 58921, U.S.N.M., taken October 2, is in perfect winter coat, and the black bar on the tail—the first part to acquire the winter coat—is already fading to brownish. Eleven specimens from the San Pedro Valley, taken October 14 and 21, are all in winter pelage, except a small area on the front of the head in several specimens.

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[a] Bull. Am. Mus. Nat. Hist., III, 1890, pp. 41–116.

A half-grown male (No. 20,536, U.S.N.M.), taken at Monument No. 66 (Lang's Ranch), in the Animas Valley, had acquired the winter coating to the posterior half of the body as early as July 5. This illustrates the importance of excluding young individuals when studying seasonal changes of pelage in mammals of warm countries.

Remarks.—Four specimens from Belen, on the Rio Grande, in Texas, have remarkably long tails, with considerable terminal black on them. They are a good step from typical *C. ludovicianus* toward *C. mexicanus.*

Habits and local distribution.—Capt. John G. Bourke, U. S. A., in an account of the Arizona Flora and Fauna,[a] writing of the region about Old Camp Grant, on the San Pedro River, Arizona, says:

> And so with the animal life; the deer, of the strange variety called "the mule;" the coyotes, badgers, polecats, rabbits, gophers, but not the prairiedog, which, for some reason never understood by me, does not cross into Arizona, or, to be more accurate, does just cross over the New Mexican boundary at Fort Bowie, in the southeast [*Cynomys ludovicianus arizonensis*], and at Tom Keam's ranch, in the Moqui country, in the extreme northeast [*Cynomys gunnisoni*].

In the year 1885 I observed immense colonies of Arizona prairiedogs in the region contiguous to the Southern Pacific Railroad in southeastern Arizona, extending as far west as the town of Benson, on the San Pedro River. Other colonies were located in the region about the junction of the Gila and Salt rivers, also in the Sulphur Spring Valley. For miles the burrows of these animals are thickly scattered over the plains south of the Pinaleno Range or Sierra Bonito, where the soil is clayey and better suited to the habits of this animal than the loose sand of most of Arizona. Here the "dogs" fairly reveled and overran the country. As we rode amongst them their sharp barking was incessant and their tameness surprising. We had no difficulty in obtaining as many specimens as we desired, as they were easily killed with shotguns, although, from the form of their burrows, many rolled out of reach before we could secure them. The burrows descend at first obliquely for two or three feet, then make a sudden bend in the opposite direction, so that, even when shot dead, their rotund bodies will double up and roll down the incline past the angle out of reach simply by force of gravity. We found that a shot delivered from exactly in front of the animal as it sat at the top of its mound with head and shoulders above the rim of earth that formed a breastwork around it, would almost always kill it instantly. A good many occupied-burrows had no mounds whatever around them. I saw three adults enter a single burrow, and Dr. Paul Clendennin, U. S. A., who accompanied me, killed two at once that were barking together in the same hole. White-necked ravens (*Corvus cryptoleucus*) were numerous about these extensive "dog towns," and are said to destroy many of the young prairie-dogs.

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[a] On the Border with Crook, 2d ed., 1892, p. 9.

In wild regions the "prairie-dog," as this squirrel is universally called, is devoid of shyness in the presence of man. As one rides up to one of their so-called "villages" he is greeted on all sides by the sharp "bark" of the "dogs," scores of whom may be seen seated erect on the large mounds which they have thrown up around the entrances to their burrows. I have seen two troops of cavalry dismount and open fire on them for several minutes without frightening them into their burrows. The energy of their barking and accompanying bobbing motion of their bodies are amusing; but, to the weary traveler in the arid wastes usually occupied by these barking squirrels, their incessant cries soon become wearisome, if not positively annoying, from the fancied challenge conveyed by their harsh tones and insolent bearing. They sit straight up on their hinder extremities and bark as loud as they possibly can until one rides toward them, when they drop down within the basin or depression at the opening of their burrows, showing only their head and shoulders. There are often several burrows in each mound, and it is a common sight to see the "dogs" leap from one side of the mound to an entrance on the opposite side, in which they disappear. They frequently keep on barking as one approaches, but gradually recede within their burrows until only the top of their flat heads, or the end of their noses, is left exposed to view, finally disappearing entirely. When frightened into their holes, some time usually elapses ere they regain sufficient confidence to reappear; then a nose is cautiously raised to view, its owner attunes its voice to the familiar strain, and is speedily joined by the whole community.

They are not disturbed by the building of a railroad across their domains; on the contrary, the passing trains enliven their desert home and beguile their leisure hours. Some sit up and watch the locomotive thundering by without becoming in the slightest degree disconcerted thereby, evidently regarding it as a creation for their especial entertainment; others, to whom the noise and smoke are as "an oft-told tale," are sprawling flat across the summit of their mounds, phlegmatically enjoying the accustomed sun-bath, while some jump playfully up into the air as the train rushes past them.

The source whence the prairie-dog derives the water necessary for its subsistence is a fruitful topic of discussion among frontiersmen. Some assert that it requires no water for drinking; others maintaining that it digs deep wells, some of which are recognizable by the unusually large mounds about their entrances and the wet tracks of the animals returned from drinking. Mr. Stewart Daniels opines that prairie-dogs live only where there is good water, in support of which assertion he has kindly placed me in possession of the following facts:

> The *Jornada del Muerto* is a plain 100 miles in length, beginning near Fort Craig, New Mexico, in the north, ending near Rincon, New Mexico, in the south. This *jornada* lies between the Sierra Cabello and the San Andres Mountains, having an average breadth of about 25 miles. This waterless tract was formerly traversed at considerable risk, being a short route cutting off a great bend of the Rio Grande. Major Jack Martin, of the California Volunteers, in response to an offer of a sum of money by the United States Government to any person who would find water on this desert, resolved to try and selected the only prairie-dog "town" on the route for the scene of his operations. After sinking to the depth of about 90, feet an abundance of excellent water was obtained. Martin's well has since received the name of Aleman, and the Atchison, Topeka and Santa Fe Railroad has taken the place of the old trail. Several wells have been dug along it, and at various points on the *jornada*, but no sweet water has been discovered, although salt water was occasionally found.

It is probable that, like sheep, these mammals can exist for a considerable period without water, although they drink with avidity when in captivity.

On the Boundary Survey, when traveling by rail between Fort Worth and El Paso, Texas, February 1, 1892, an area inhabited by a large colony of prairie-dogs was crossed near Baird. In February, 1892, I visited a colony on the mesa seven miles northeast of El Paso, Texas, near the present site of Fort Bliss, Texas, and other small colonies were observed farther down the Rio Grande.

From a letter addressed to me by Dr. Paul Clendennin, dated "Fort Davis, Texas, May 27, 1885," I extract the following:

> There are lots of prairie-dogs all around the fort. They are very tame indeed, and it is very amusing to watch them.

The name "Dog Spring," Grant County, New Mexico, came originally from the colonies of prairie-dogs in the neighborhood. From three miles west of the Dog Mountains, colonies of prairie-dogs extend all the way to the San Luis Mountains, not quite reaching the lower timber line. The species is abundant on both sides of the Animas Valley, west of the San Luis Mountains, reaching the timber line on both sides. I rode through a colony between Gage and Separ, New Mexico, April 25, 1885. The "dogs" were still "barking," although the entire column—a full regiment of cavalry—had just passed through on the same trail.

While camped at Lang's ranch (Monument No. 66) I experimented in trapping prairie-dogs, and found them about the most difficult rodents to take with steel traps, but there was not the slightest difficulty in capturing them by means of snares placed around the openings of their burrows. Many badgers were feeding upon the prairie-dogs of the Animas Valley, and hundreds of skulls of the "dogs" were scattered about the mounds.

Cranial measurements of four adults of Cynomys ludovicianus arizonensis from southern Arizona.

Museum number.[a]	Original number.	Sex.	Total length.	Greatest breadth.	Height of skull.	Distance between orbits.	Nasal bones, length.	Nasal bones, width before at widest point.	Upper incisors, from front to posterior margin of palate.	Length of upper molariform series.	Distance between last upper molars.	From posterior border of incisors to foramen magnum.	Antero-posterior diameter of audital bullæ.	Greatest breadth of zygoma.	Length of mandible measured from condyle.	Length of under molariform series.
			mm.	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
1774	187	♀	61.5	......	26.0	14.2	22.5	9.4	35.5	17.0	4.9	51.3	13.0	.....	42	15.0
1775	190	♂	65.8	44.3	28.0	14.6	25.0	10.2	36.0	16.0	4.9	53.5	11.8	4.8	43	15.4
1776	359	♂	66.0	45.5	28.6	13.2	24.7	10.2	37.0	16.5	4.8	51.8	13.6	5.0	44	15.2
1777	360	♀	63.0	45.5	27.7	14.0	24.0	10.0	35.5	16.5	4.2	52.0	13.7	5.0	43	16.0

[a] American Museum of Natural History.

CYNOMYS GUNNISONI Baird.

SHORT-TAILED PRAIRIE-DOG.

Cynomys gunnisoni BAIRD, Proc. Acad. Nat. Sci. Phila., VII, Apr., 1855, p. 334 (original description); Mam. N. Am., 1857, p. 335.—MERRIAM, North American Fauna, No. 3, 1890, p. 58, pl. IX, figs. 5, 6, 7 (skull); No. 5, July 30, 1891, p. 40.—PRICE, Bull. Am. Mus. Nat. Hist., VII, 1895, p. 237, note.

[*Cynomys*] *gunnisoni*, ELLIOT, Field Col. Mus., Zool., Ser. II, 1901 (Synop. Mam. N. Am.); IV, 1904, p. 156 (Mam. Mid. Am.).

Tŭck-sē′ of the Hualapi Indians.

Tĭll′kēhä of the Hopi Indians.

Type-locality.—Cooachetope (Cochetopa Pass), Rocky Mountains, Saguache County, Colorado. (Type, skull, Cat. No. 501 (skin lost), U. S. National Museum.)

Geographical range. Transition zone of the Colorado Plateau and mountains of northeastern Arizona and northwestern New Mexico, and thence northward.

Description.—Size small. Length, 350 mm.; tail vertebræ, 70; hind foot, 60; head 67. Skull, 60 by 43. Mammæ, 5 pairs. In summer, tawny fulvous above, grizzled and much mixed with black hairs; forehead blackish, especially above the eyes; tail without terminal black, but often with many blackish hairs above and a narrow subterminal bar, resulting from broad black annulation of the hairs, the dark rings increasing in extent from the base of the tail to its extremity. In winter, pale buff above, mixed with black hairs, which aggregate to form blackish patches over the eyes; color below varying from pale yellow to fulvous. It appears less grizzled than *Cynomys ludovicianus*, because it lacks the strong vinaceous tint.

The short-tailed prairie-dog is abundant on the mesas and open parks of Arizona, often living in pine forests, and sometimes in cliffs, where it climbs over the rocks like the large ground-squirrel (*Otosper-*

mophilus grammurus). Those from the Agua Fria Valley differ somewhat in appearance from the form occupying the Colorado Plateau, and may merit separation as a race. As all but one of my specimens from the Agua Fria Valley were preserved in a solution that discolors the pelage, the materials requisite for a satisfactory comparison are lacking.

Habits and local distribution.—The alpine barking-squirrel or short-tailed prairie-dog is locally abundant over the northeast third of Arizona. I did not meet with it in the western portion of the Territory. Although it prefers the highest plains, it is by no means unknown to the mountains of Arizona, where I have seen colonies living in the pine forests, and have found it as high as 8,000 feet above sea level. Along the Atlantic and Pacific Railroad numerous colonies were noted as far west as Bill Williams Mountain. To the north of his railroad a large area between the Colorado River and Cataract Creek is occupied by it.

Late in May, 1887, I found large colonies residing in the large basin known as the Mormon Lake, in the Mogollon Mountains. They encroached upon the boggy soil adjacent to the lake, where they were so close to the water level that they had constructed enormous mounds, often 20 feet in diameter and of considerable height, apparently to insure dryness of their habitations. Be this as it may, those living in the neighboring rocky mesa had formed scarcely any mounds. Colonies were noted at frequent intervals between the Mormon Lake and Flagstaff, Arizona, especially on the open plain known as Clarkes Valley, through which a railroad was then being built. A few young ones were already abroad and sat up erect and acted like adults, although not as large as the eastern red squirrel or chickeree. The first young one was seen at Mormon Lake on May 31. This was in the pine belt. The young are brought forth a month earlier in the low, hot plains, and hundreds of little ones no longer than Say's chipmunk were seen near Flagstaff on the 27th of June of the same year. Several "dog towns" were seen in the pine forest, where the animals were easily shot from the concealment afforded by the tree trunks. The soldiers of my party shot and ate a number of them, and pronounced their flesh excellent, but to my taste they had an earthy flavor that was decidedly unsavory, although they were fat and their flesh tender and juicy. Some were living in cliffy hillsides, burrowing under rocks, over which they climbed with easy confidence, often choosing the top of some large one for a rostrum from which to salute one's approach with their noisy "barking." Near Flagstaff a colony occupied a hillside adjoining a wheat field, which latter they totally destroyed, notwithstanding the efforts of the owner to save his crop. Experience had taught the adults shyness; but, on returning to the place late in June, the young were frolicking abroad in numerous families in utter disregard of our presence. Near Chavez Pass enormous areas were covered by their colonies.

In Aravaipa Canyon, in southern Arizona, the Arizona prairie-dogs (*Cynomys ludovicianus arizonensis*) were active during the coldest weather; but the short-tailed prairie-dogs living in the Agua Fria Valley between Forts Verde and Whipple do not appear during the coldest periods, but venture forth as soon as the weather moderates. Probably those residing on the San Francisco Mountains, where the winter is long and cold and the ground deeply covered with snow, regularly hibernate, as the large ground-squirrel (*Otospermophilus grammurus*) is known to do; but early in April, 1886, we found them out of their burrows, close to the snow which still covered the divide of the Mogollon Mountains.

This barking-squirrel is graminivorous, devouring nearly every green thing within its settlements, which in consequence become barren and forbidding in appearance. Lack of food or sudden inundations are the ordinary causes leading to a change of location, which is usually accomplished by a gradual invasion of contiguous territory.

An interesting chapter might be written under the caption of "The prairie-dog as a pet," to which every army youngster could contribute something of interest from personal experience. In captivity it is playful, and makes an extraordinarily bright and agreeable pet. It is fond of raw meat, and drinks water freely. Its propensity for undermining the walls of the buildings and digging up the yards is regarded as reprehensible by some; but, to juvenile minds, such trifling peccadillos are more than compensated for by its clever tricks and its attachment for its master, at whose clothing it will tug when ready for a frolic or desirous of being fed.

Measurements of 77 specimens of the genus Cynomys.

Museum number. Skin.	Museum number. Skull.	Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind foot.	Height of ear above crown.
			Cynomys gunnisoni.	1884.		*mm.*	*mm.*	*mm*	*mm.*
[a]2192	In skin	96	Agua Fria post office, central Arizona	Apr 25	♀ ad.	333	63	55	5.0
				1887					
[a]12164	1770	637	....do	Nov 6	♂ ad	345	70	60	6.0
[a]2193	....	638	....do	....do	♂ ad	366	80	62	6.0
[a]2193 bis	....	639	....do	....do	♂ ad	357	65	61	7.0
[a]12165	....	640	....do	....do	♂ ad	351	72	61	6.0
[a]2183	1769	569	Mormon Lake, Mogollon Mountains, Arizona.	May 30	♂ ad.	360	73	62	7.5
[a]12163	1773	570	....do	May 31	♀ ad.	332	65	55	6.0

[a] American Museum of Natural History

Measurements of 77 specimens of the genus Cynomys—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind foot.	Height of ear above crown.
Skin.	Skull.								
			Cynomys gunnisoni—Cont'd.	1887.		*mm.*	*mm.*	*mm.*	*mm.*
[a]2190	....	571	Clarks Valley, Mogollon Mountains, Arizona.	May 31	♂ ad.	357	73	60	8.0
[a]2184	1771	572	.....do	....do	♀ ad.	337	64	55	7.0
[a]2189	In skin.	575	Near Flagstaff, Arizona	June 2	♂ ad.	350	67	62	8.5
[a]2186	1772	576	.....do	....do	♂ ad.	341	68	59	8.5
			Cynomys ludovicianus arizonensis.	1885.					
....	....	176	Point of mountain, near Willcox, Arizona.	Apr. 9	♂ ad.	368	92	62	8.0
....	....	177	.....do	....do	♂ ad.	359	76	60	6.0
....	....	178	.....do	....do	♂ ad.	477	81	60	7.0
....	....	179	.....do	....do	♂ ad.	371	81	58	6.0
....	....	180	.....do	....do	♂ ad.	398	88	63	7.0
....	....	181	.....do	....do	♂ ad.	394	88	64	6.0
[a]2187	....	182	.....do	....do	♀ ad.	350	77	62	5.0
[a]2188	....	183	.....do	....do	♀ ad.	353	73	58	5.0
[a]12162	2509	184	.....do	....do	[b]♀.	330	58	55	6.0
....	....	185	.....do	....do	♀ ad.	357	80	61	6.0
....	....	186	.....do	....do	♀ ad.	364	83	63	7.0
[a]12161	1774	187	.....do	....do	♀ ad.	365	82	58	5.0
[a]2185	1775	190	Dragoon Summit, Arizona	May 3	♂ ad.	364	84	62	6.0
20112	35467	1422	Fort Bliss, near El Paso, Texas.	Feb. 7	♂ ad.	386	89	65	6.0
20113	35468	1422	.....do	....do	[c]♀ ad.	318	80	59	5.0
				1893.					
21059	36101	2346	Belen, El Paso County Texas.	June 19	[c]♀ ad.	400	103	67	6.0
21061	36103	2347	.....do	....do	[c]♀ ad.	402	104	63	6.0
21060	36102	2348	.....do	....do	♀ ad.	383	103	66	6.0
21061	36101	2349	.....do	....do	♀ im.	320	83	61	......
				1892.					
20377	35907	1783	Dog Spring, Grant County New Mexico.	May 25	♀ ad.	347	76	57	5.0
20372	35902	1784	.....do	....do	♂ ad.	358	83	62	5.0
20374	35904	1785	.....do	May 27	♂ ad.	382	86	63	6.0
20378	35908	1786	.....do	....do	♀ ad.	360	74	60	5.5
20376	35906	1787	.....do	....do	♀ ad.	377	83	58	5.0
20379	35909	1788	.....do	....do	♀ ad.	373	88	61	5.0
20380	35910	1789	.....do	....do	♂ ad.	412	91	66	5.0
20375	35905	1790	.....do	....do	♀ ad.	379	87	61	5.0
20538	35724	1923	Lang's Ranch, Monument No. 66	June 29	♂ ad.	350	84	63	1.3
20541	35710	1924	.....do	....do	♂ ad.	465	90	65	5.5
20540	35694	1925	.....do	....do	♂ ad.	390	81	61	6.0
20533	37028	1926	.....do	....do	♂ im.	357	93	63	......
20537	35732	1927	.....do	....do	♀ ad.	360	84	61	4.3
20534	35703	1929	.....do	....do	♂ im.	330	73	61	......
20539	35728	1930	.....do	....do	♀ ad.	376	92	60	6.0
20536	35712	1939	.....do	July 5	♂ juv.	.....	.....	.....	......
20535	35707	1940	.....do	....do	♀ ad.	350	80	60	4.0

[a] American Museum of Natural History. [b] Type. [c] Had suckled young.

Measurements of 77 specimens of the genus Cynomys—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Height of ear above crown.
Skin.	Skull.								
			Cynomys ludovicianus arizonensis—Continued.	1893.		*mm.*	*mm.*	*mm.*	*mm.*
58918	58918	2480	Lang's Ranch, Monument No. 66.	Aug. 31	[a]♀ ad.	380	80	60	5.0
58915	58915	2481	.....do	...do....	♂ ad.	390	85	65	5.0
58916	58916	2482	.....do	...do....	♂ ad.	400	89	64	5.0
58922	58922	2494	.....do	Sept. 3	♂ ad.	430	103	66	5.0
58923	58923	2495	.....do	...do....	[a]♂ ad.	387	81	62	5.0
58919	36368	2503	.....do	Sept. 5	♂ ad.	370	80	58	5.0
58920	58920	2564	AnimasValley, Grant County, New Mexico.	Oct. 2	♂ ad.	395	83	64	5.0
58921	58921	2565	.....do	...do....	♂ ad.	400	80	64	5.0
....	37035	2566	.....do	...do....	♀ ad.	378	79	61	5.0
				1892.					
20532	35717	1992	Cloverdale, Grant County, New Mexico.	July 18	♂ ad.	380	90	63	5.0
20733	35876	2119	San Pedro River, at Monument No. 98.	Oct. 14	♀ ad.	360	85	62	5.5
20727	35871	2120	.....do	...do....	♀ ad.	350	74	59	5.5
20731	35875	2121	.....do	...do....	♂ ad.	390	92	63	5.0
20734	35877	2122	.....do	...do....	♂ ad.	360	83	63	5.0
20736	35879	2123	.....do	...do....	♂ ad.	380	92	64	5.5
20729	35873	2124	.....do	...do....	♂ ad.	400	89	64	5.5
20728	35872	2125	.....do	Oct. 14	♂ ad.	350	78	60	5.0
20732	37033	2126	.....do	...do....	♀ ad.	355	77	60	5.5
20730	35874	2141	.....do	Oct. 21	♂ ad.	380	81	64	5.0
20735	35878	2142	.....do	...do....	♀ ad.	358	78	61	5.2
				1893.					
21381	36170	2428	.....do	July 28	[a]♀ ad.	367	78	61	5.0
21386	36178	2429	.....do	...do....	[a]♀ ad.	349	68	58	5.0
21379	36172	2430	.....do	...do....	[a]♀ ad.	360	88	59	5.0
21385	36179	2431	.....do	...do....	[a]♀ ad.	373	83	63	5.0
21384	36177	2432	.....do	...do....	[a]♀ ad.	365	70	63	5.0
21377	36171	2433	.....do	...do....	♂ ad.	387	96	62	5.0
21378	36174	2434	.....do	...do....	♂ ad.	382	91	64	5.0
21382	36176	2435	.....do	...do....	♂ ad.	392	90	62	5.0
21383	36175	2436	.....do	...do....	♂ ad.	392	95	62	5.0
21380	36173	2437	.....do	...do....	[b]♂ ad.	360	63	61	5.0

[a] Mammæ, 4 pairs.

[b] Tail abnormal.

Family CASTORIDÆ.

BEAVERS.

Skull massive, without postorbital processes, the angle of the mandible rounded, and the cheek-teeth rootless, with re-entering enamel-folds. Premolars $\frac{1}{1}$. Habits natatorial. (*Flower and Lydekker.*)

Genus CASTOR Linnæus (1766).

Castor Linnæus, Syst. Nat., 12th ed., 1766, 1, p. 78.

The upper molar teeth are subequal, each with one internal and two external enamel-folds; the stomach has a large glandular mass situated to the right of the œsophageal orifice; the anal and urethrogenital orifices open within a common cloaca; the tail is broad, horizontally flattened, and naked; and the hind feet are webbed. (*Flower and Lydekker.*)

CASTOR CANADENSIS FRONDATOR Mearns.

BROAD-TAILED BEAVER; SONORAN BEAVER.

Castor canadensis frondator Mearns, Proc. U. S. Nat. Mus., XX, p. 503, Jan. 19, 1898, (advance sheet issued Mar. 5, 1897; original description.—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 63 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Castor canadensis*] *frondator*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 116 (Synop. Mam. N. Am.).

Castor c[*anadensis*] *frondator*, Elliot, Field Col. Mus., Zool. Ser., IV, 1904, pp. 159 to 161, fig. 30 (skull of type); fig. 34 (animal). (Mam. Mid. Am.).

Päh-höné-äh of the Hopi Indians.

Ap-ē′-nä of the Hualapai Indians.

Type-locality.—San Pedro River, Sonora, Mexico, near Monument No. 98.—(Type, skin and skull, No. $\frac{20750}{35883}$, U. S. National Museum.)

Geographical range.—This form occupies the southern interior area of North America, ranging north from Mexico to Wyoming and Montana, its habitat being, of course, restricted to the vicinity of wooded streams, which it follows through the Austral and Transition zones.

Description.—Larger than the beaver of Canada, paler and different in coloration, with a much broader tail. Above russet, changing to chocolate on the caudal peduncle above, and to burnt sienna on the feet; toes reddish chocolate. Below grayish cinnamon, brightening to ferruginous on the under side of the caudal peduncle. Sides wood-brown, enlivened by the tawny olive color of the overhair. Length, 1,070 mm.; length of tail, measured from anus, 360; length of bare portion of tail, 125; height of ear from crown, 31; height of ear from anterior base, 35; distance from tip of nose to eye, 68; from tip of nose to ear, 125; nose to occiput, 165; length of manus, with claw, 82; length of pes, with claw, 185. Skull, 133 mm. by 99. Weight, 62 pounds avoirdupois.

Cranial characters.—The skull of the European beaver (*Castor fiber*), which is readily distinguishable from that of the Canadian beaver (*Castor canadensis*) by its slender build, lengthened nasal bones, and elongated rostral portion, presents still greater differences when compared with the beaver of Arizona and Sonora. There being at present no forest connection between the habitats of *Castor fiber* and *C. canadensis* in their respective geographic ranges, and consequently no continuity of habitat, there can be no question as to their specific distinctness. The skull of *C. canadensis frondator* (fig. 57) differs from that of typical *C. canadensis* in being much larger, with more spreading zygomata.

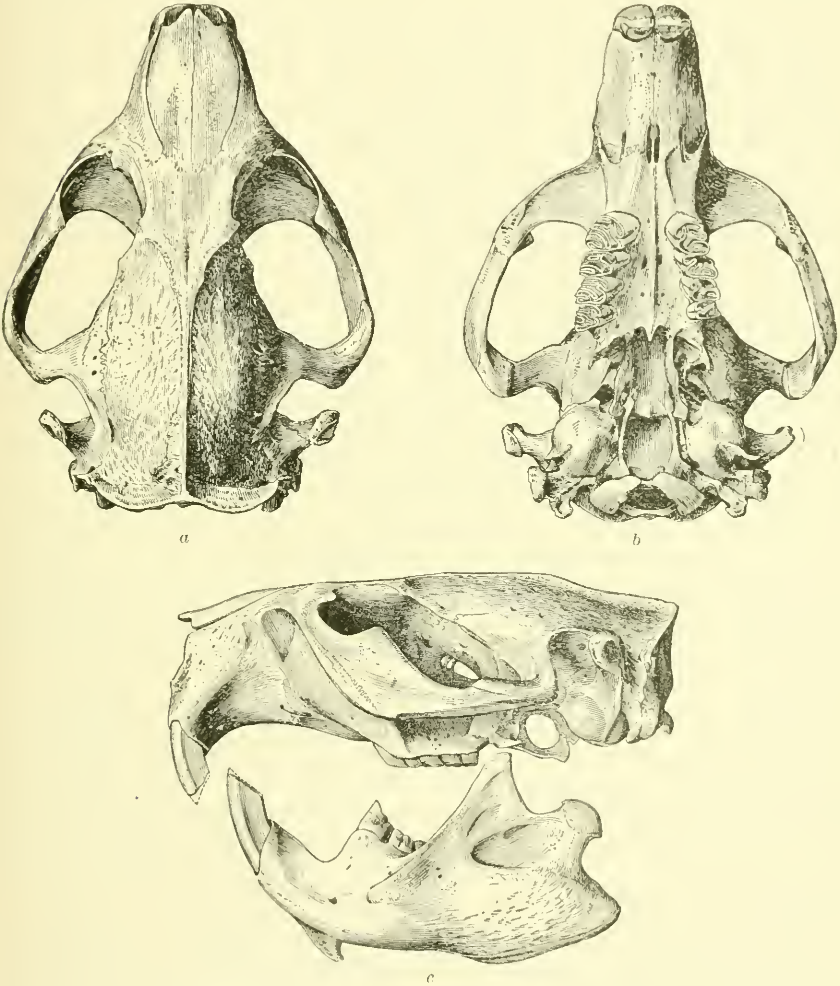

Fig. 57.—Castor canadensis frondator. (Type, Cat. No. 35883, U.S.N.M. *a*, Dorsal view; *b*. Ventral view. *c*, Lateral View.

Variations.—In the year 1885 I purchased from a professional trapper 17 beaver skins, taken on the Verde River during the winter of 1884–85. These skins were dried in oval shapes on looped sticks in the usual way and weighed 29 pounds avoidupois, costing $1 a pound. The fur was quite heavy, and was made into capes, muffs, and a coat, which are still serviceable. The adult skins measured as follows: 1,090 by 700 mm., 1,060 by 720, 1,010 by 840, 970 by 780, 950 by 650, 940 by 770, 930 by 800, 930 by 700, 920 by 750, 900 by 770. Four young of the year measured 760 by 600, 710 by 600, 670 by 580, 695 by 620. One in the second year measured 720 by 610. Two in the third year measured 820 by 680, 810 by 720. As in all Arizona beavers, the hides are thick and indurated, especially those of old males that have many scars from fighting; and the coat is poorer in quality and less dense than in northern skins. The fur, however, is quite full and handsome. Ten of these skins are of adults, taken between December and March, and stretched to a nearly perfect ellipse. Of these, No. 168 (original number) is the largest, darkest, and handsomest, being in perfect winter pelage. The skin measures 930 by 800 mm., and weighs 2¼ pounds. There is an area of dark, reddish brown extending from the forehead to the root of the tail, where the color changes to a darker hue of shining vinaceous-chestnut, a lighter shade of which extends to the under surface of the caudal peduncle and inner surface of the thighs. The sides are rather uniform (slightly reddish) fulvous. The underfur is of about the same color terminally but grayish at the base of the hairs; that upon the dorsum is rich brown. There is no ventral chestnut stripe in this specimen.

The remaining nine adult winter specimens exhibit certain color differences amounting to a considerable variation. No. 169 has the dorsum paler and less reddish; the sides and belly are uniformly brownish gray, with no tinge of red or fulvous, while the rump is paler than the back, and more yellowish than in the above specimen, this shading into dark vinaceous posteriorly and beneath. The skin measures 1,090 by 700 mm.

Between the extremes above described are various gradations in color. In some skins there is a distinctly darker ventral stripe, and occasionally the sides are of a brighter yellowish fulvous. In some the top of the head is darker, in others lighter, than the rest of the dorsum; but in all the muzzle, sides, and under surface of the head and neck are pale, so that the skin exhibits a triangular dark patch above, corresponding to the crown of the head.

Young of the year (from four skins taken in midwinter).—These are strikingly paler than adults at the same season. They present a central area of reddish brown and two broad, lateral bands of nearly uniform brownish gray, faintly washed with fulvous. The ventral surface is appreciably darkest in the median line. The sides of the head are washed with fulvous. The rump and base of tail are pale chestnut-fulvous, with less of the vinaceous tint than in adults.

Three immature skins, presumably in their second and third years, respectively, present color characters intermediate between those of the young of the year and the adult.

Summer pelage of adult (adult male No. $\frac{3336}{1854}$, coll. Amer. Mus. Nat. Hist., New York, taken at Fort Verde, Arizona, August 16, 1884).—Upper parts pale reddish fulvous, much paler and more uniform than in any winter specimen. A darker vertebral area is indicated. The rump and upper side of the tail are considerably paler and more yellowish than in winter. The long hairs of the sides, giving the general body color, are paler yellowish fulvous; and the same shade prevails on the under parts, where the overhair is very scanty. Along the middle of the belly is a band of dark, shining chestnut, a paler, barely apparent shade of which extends forward to between the fore legs and more distinctly backward to the vent. The under side of the tail, posterior to the anal orifice, is reddish chestnut, paler than the dark area of the middle of the belly. The bare sole of the hind foot is fringed behind the heel with a band of long, chestnut-red hairs. The upper surface of the hind feet is covered with coarse hairs of a dark vinaceous color, with a few markings of fulvous, especially upon the terminal portion of the toes. The front, sides, and under surface of the head and the fore legs and feet are a paler shade of fulvous than the rest of the body; and the feet are marked above with a few irregular vinaceous blotches (mixed with brown) similar to, but paler than, those of the hind feet. The soft underfur is dark, grayish brown on the upper parts, becoming pale grayish on the under parts.

Very young specimens, taken in June, have a drabish coloration.

Remarks.—The beaver of Canada and the northeastern United States (*Castor canadensis canadensis*) is of a beautiful glossy bay on the upper surface, paling to chestnut on the head and rump. The under surface is seal brown. Sometimes the color is still darker, the back being blackish brown, the caudal peduncle burnt umber, and the under side of head vandyke brown. The feet are seal brown. I have examined thirty-three skulls and a large number of skins of *C. canadensis frondator*, from Arizona and Sonora. In old males the total length reaches 1,130 mm., and the bare and scaly portion of the tail measures 285 by 155. Adult males weigh 60 pounds and upward; females 40 to 50 pounds.

Beavers are found throughout the Rio Grande Valley, except where civilization has caused their disappearance. At El Paso I bought some beaver traps from a trapper, but was unable to catch any beavers. Some were living on Las Moras Creek, near Fort Clark, Texas, but they also eluded me. Not having obtained a specimen, I can not say whether the Texas beaver is most like *Castor canadensis carolinensis* Rhoads or the present subspecies. Skins of the Arizona beaver make elegant rugs, robes, and even fur trimmings when the long overhair has been plucked out; but the price at which they were sold shows that beaver trapping was not a remunerative occupation in Arizona, which is further attested by the great abundance of these animals along the rivers of the Territory during the early eighties. I have had large skins offered me, prepared with less skill and pains than those above described for 50 cents apiece; but the value has risen so that a trapper named Milligan, who obtained more than 100 skins on the Gila and Verde rivers during the winter of 1886–87, selling them by the pound, received an average price of $5 apiece. The largest beaver taken by Mr. Milligan weighed 73 pounds.

Habits and local distribution.—Signs of the beaver were evident on nearly all of the streams of the Colorado Basin visited by me from March, 1884, to May, 1888. I always found this animal to be excessively shy, secretive, and difficult of observation, in these respects quite different from the half-tame beavers of the Yellowstone National Park. The slight amount of information respecting them that I was able to obtain while in Arizona can be best presented in the form of extracts from my diary of those years, as follows:

July 18, 1884, Fort Verde, Arizona.—Beavers are abundant in pools of Beaver Creek from above Montezuma Well to the Verde River. Mr. Henry Mehrens, a settler living just below Montezuma Well, says he frequently sees them in pools of Beaver Creek, which are there densely bordered by tule (*Scirpus*) and surrounded by willow and cottonwood trees, upon which they feed. He informed me that beaver frequent the irrigation ditches of the ranches along the stream, doing some damage to the ditches and shade trees planted along them.

August 16, 1884, Fort Verde, Arizona.—I killed an old male beaver about 3 miles above the post of Fort Verde, in the Verde River. I first saw it in the river a good way above me, floating like a piece of driftwood, low in the water. For some time I was unable to make out whether it was an animal or not; but I soon saw it move its head up and down slightly, and then I felt sure that it was a beaver—the first one I ever saw. Every walk I had taken along the banks of the Verde River had revealed to me evidences of the abundance and industry of this singular beast. Large cottonwood trees were to be seen with trunks gnawed half through, which, on the next occasion that I visited the spot, were lying prostrate, felled by the beaver. Numbers of cottonwood trees had been cut down by them during the preceding two months, and in some places every tree near the water and some good-sized ones at quite a distance from the stream had been cut, until the spot resembled a clearing made by the woodman's ax. The saplings and limbs were frequently dragged to form a large windrow beside the river bank, in doing which well-made paths had been swept in the sand and loam by the industrious beavers. I had not seen any typical or recently occupied beaver dams, although there were remains of several old ones near the post of Fort Verde. But notwithstanding the plentitude of beavers not one had before been seen, although the streams had been forded at night and in the evening many times. This one was seen on a cloudy day, after a shower, and was shot from an ambush as it swam slowly down the river channel, with only its head visible above the surface of the water most of the time, although it sometimes floated higher and drifted like a board. It was so large and heavy that it was with difficulty removed to a small tree and hung up in the shade.

August 11, 1884, Fort Verde, Arizona.—Visited a spot two miles above the post where beavers had been hard at work cutting cottonwood trees and lopping off the branches close to the trunk. Well-worn paths had been made by them when carrying the branches to the river. I was walking silently and cautiously in the shade of the cottonwoods at a place where the bluff bank was about 10 feet high, when I noticed a ripple proceeding from the nearer shore beneath some jutting roots and brushwood, and crept stealthily to the shore and saw that there was a great commotion in the water. In fact, the whole stream was quaking from the rapid movements of some animal beneath the surface. Soon the head of a large beaver emerged from the shallow water on the opposite side, and in a moment another and another. It proved to be a beaver mother giving instructions to her kittens in the art of swimming. I quickly pulled both triggers of my shotgun. Then there was a splash, and for a moment the water and sand fairly boiled, after which there was only the spasmodic kicking and flapping of a wounded beaver, which was secured, not however without difficulty, from a dangerous quicksand among some stranded snags of trees about which the beavers had been trying to build a dam. On this account the beaver colony was not subsequently molested by me, as I was desirous of observing their method of work on the attempted dam.

August 21, 1884, Fort Verde, Arizona.—This evening I repaired to the spot where I shot the beaver and watched for these animals until it was pitch dark. I saw a large beaver at work on the dam, but it flapped its tail on the water and dived upstream, and I did not see it again. As the darkness increased I could hear them splashing in the water and flapping their tails on the ground with a sharp thud from time to time, but I could see nothing, as the night was dark save when a distant flash of lightning illumined the water for a second.

August 22, 1884, Fort Verde, Arizona.—The beavers are putting forth strenuous efforts to cut down all the timber near their dam. I am interested to see whether they will actually succeed in cutting off some large trees from which they have stripped the bark and on which they have commenced to chisel the wood. Some of these trees are cottonwoods, two feet or more in diameter. Beavers have already felled some of the largest trees in the vicinity, and it is probable that others will soon follow. The limbs have been cut from the felled trees at the trunk and carried off. To cut some of them the animals had to climb along the trunk to a position 10 to 15 feet above the ground. There are numerous beaver slides in the vicinity of the dam, and these are well worn and cleanly brushed by the leafy boughs that have been dragged down them.

September 4, 1884, Fort Verde, Arizona.—To-day I shot a young male beaver. Its stomach was nearly filled with the bark of the cottonwood. We had this young beaver served on our table, and all who partook of it pronounced it to be excellent meat.

September 12, 1884, Fort Verde, Arizona.—One young beaver was seen swimming in the Verde River with only the nose and fore part of the head out of water. It climbed out upon the opposite river bank, where I obtained a good view of it.

October 17, 1884, Gila River at the San Carlos Indian Agency.—Beavers are abundant. I saw many cottonwoods cut down or gnawed by them.

October 25, 1884, Fossil Creek, Arizona.—Beavers are numerous on this stream. While on this expedition (with General Crook) I saw fresh signs of the beaver on White River, the Gila, Salt River, and Tonto Creek, and old signs on Pine Creek, all in Arizona.

January 17, 1885, Indian Garden, Oak Creek, Arizona.—Beavers have cut many small saplings, but no large trees, along this stream.

May 13, 1885, Gila and Salt rivers, near Phoenix, Arizona.—Tracks and cuttings of the beaver were seen.

June, 1885, Fort Verde, Arizona.—Early in June, when fishing for bonytail (*Gila*) on a sluice of the Verde River, I accidentally stumbled upon a nest containing three young beavers, two of which I took for specimens on another occasion (June 13). The nest was contained in a hollow of the large decayed bole of ash trees that grew out of a common base, and was composed of stalks and leaves of sedge, tule, and herbs, together with some dry leaves and fine rootlets that had been washed bare by the stream. On this neat and soft bed were the three little ones. The mother dived into the pool which had undermined the trees along the jutting bank, but soon came back to look after her progeny and was quite bold. On subsequent visits to this nest I heard the splash of the parent when I approached the spot, and the progeny followed her example as soon as I reached them. The mother did not appear, but the young ones swam freely around the pool in my presence.

June 19, 1885, Fossil Creek, Arizona.—Beavers were seen in Fossil Creek, central Arizona.

October 1, 1885, Fort Verde, Arizona.—Being desirous of obtaining a handsome section of a cottonwood tree bearing the marks of the beaver's teeth, I selected an immense one which the beavers had cut two-thirds through, and which exhibited well the marks of their teeth and their apparent intention and ability to fell a tree in a particular direction. Colonel Clendennin, commanding the post, kindly allowed me to take a large crosscut, double-handed saw and the provost sergeant with two men. The tree proved to be larger than I had supposed, and we were unable to saw it down. As a good deal of heavy cottonwood timber had been cut by beavers in that vicinity, I measured the circumference of the trunks of six of the larger trees. The measurements, taken above the cutting, were as follows: 31½ inches, 21½, 55½, 36, 87½, and 89. One or two of the trees measured were still standing nearly cut through, but these were felled by the beavers soon after and carried away by them, with the exception of the heaviest trunks from which all the branches were gnawed.

November 7, 1885.—A prospector related a story of a fight between a beaver and mountain lion. The miner, encamped on the Colorado River at a point where there was a broad sand flat, saw a beaver in the early morning crossing the sand flat to a strip of cottonwood timber, whence it was afterwards seen dragging a stick of wood back toward the water. A mountain lion was then seen crouched in the trail watching, ready to intercept the beaver. As the latter approached the lion sprang upon it, and the two animals closed in a desperate conflict. The fortunes of war wavered, now on the side of the lion, anon on that of the beaver. The miner, taking his rifle in hand, cautiously approached the combatants and watched them from a place of concealment. After fighting a long time the beaver was left dead on the field and the lion attempted to crawl from the spot, followed by the prospector, who found it unnecessary to kill the lion with his rifle, as it soon lay down upon the sand and died from exhaustion and loss of blood.

January 22, 1886, Fort Verde, Arizona.—During the past week there have been long heavy rains. The rainfall in the valley amounted to several inches, while upon Grief Hill, 1,500 feet higher (altitude about 5,000 feet), the precipitation amounted to 5 inches. The Verde River overflowed its banks and flooded the beavers out from their burrows in the river banks. For a night or two they were seen all along the river, showing great excitement, and several of them were shot.

March 26, 1886, Fort Verde, Arizona.—A few days ago a female mallard flew from a beaver-felled cottonwood whose branches drooped into the water beyond a pile of driftwood. As I had been within a few feet of the spot for a quarter of an hour without noticing the duck, I suspected that it had a nest among the driftage. To-day, with a view to discovering the mallard's nest, I stopped and scrutinized the spot with particular care from the opposite bank of the stream, and descried a huge beaver seated upon the tree trunk beneath the débris. It had evidently been driven from its home by the very high water of the rising stream, and had sought concealment in this shady spot. When I revisited the place later in the day the beaver had returned, but only its head was out of water, and that so nearly concealed by brushwood that I caught sight of it too late for a shot. When first seen I could easily have obtained the specimen had my gun been loaded for such tough game; but it had gone before exchange of cartridges could be effected.

May 28, 1886, Fort Verde, Arizona.—Hoy, the driver of the post water wagon, brought me a large female beaver that he killed with a stone under the bank of Beaver Creek. The soldier's dog caught one of this beaver's young, which Hoy also brought to me (Nos. 6785 and 2339, coll. Amer. Mus. Nat. Hist.).

June 11, 1886, Fort Verde, Arizona.—To-day I saw a place where the beavers' castoreum had been deposited. The ground was stained blackish, and the odor was so strong as to attract my attention when riding near.

February 10, 1887, Fort Verde, Arizona.—A beaver was caught in a steel trap eight days ago, and left one fore foot in the trap. To-day it was found stranded upon a low sand island, having but recently died. The uterus contained three fetuses about 25 mm. in length. They were contained in spherical sacs as large as a hen's egg. The placenta was four times larger than the embryo, which latter had developed largely to head and hind extremities. The weight of the other was 46 pounds; eye 9.5 mm. in diameter.

March 15, 1887, Verde River, Arizona.—I saw a beaver come out of its burrow in the bank and drag a cottonwood branch into its home in broad daylight.

March 27, 1887, Fort Verde, Arizona.—I have noticed that beavers have been working on ash trees in several localities in this region of late.

April 3, 1887, Box Canyon of the Verde River.—Beavers are numerous, and have cut much of the timber along the river bank. Mr. J. P. Milligan took 120 beavers on the Gila and Verde rivers during the winter of 1886–87, and sold the skins at $2.50 a pound (about $5 apiece).

November 22 to 24, 1887.—On the East Verde River are several fine beaver dams. One of them is 4 feet high, and could not have been better built by man. This dam is superior to any other that I have seen in the region. Beavers are very plentiful on the East Verde.

I found bones of the beaver in many cliff and cave dwellings of the extinct race of man known as cliff dwellers in the Verde Valley, Arizona, from 1884 to 1888.

The dens of beavers are usually dug in the bluff banks of streams, and have the entrance at a considerable depth below the surface of the water. At the back part are usually one or more openings, probably for the purpose of admitting the air, which are concealed by brush and weeds. At Fort Verde a beaver den was partially opened, and a bulldog that had earned the reputation of being a hard fighter was admitted. In the fight that ensued the dog was badly beaten, and could not again be induced to attack a beaver.

Mr. Stuart Daniels found beavers on the Sonora River, Mexico. He also found them in abundance on the Gila River, Arizona. On the Boundary Survey they were found on the San Pedro River and on Babocomeri Creek, one of its tributaries in Arizona. Two trappers whom we met at Yuma, Arizona, in March, 1894, had recently arrived from a 200-mile trapping expedition down the Gila River. They had shipped a number of beaver and raccoon skins taken during this trip, but found no beavers on the lower portion of the Gila. I saw old beaver cuttings on the Gila in the vicinity of Adonde Siding, Arizona, in February, 1894. Residents said that there had been scarcely any beavers on the lower Gila since the flood of February, 1891, which washed them all out. One man told me that beavers were then (February, 1894) working extensively at Mohawk, on the Gila. Beavers were formerly found at Gila City, but had been driven out by previous floods. In the years 1893 and 1894 a colony of beavers was located about 12 miles below Yuma, on a lagoon of the Colorado River. Seven of them were trapped by Mr. Smart, of our party. Beavers are common on the Colorado, and doubtless sometimes ascend the Salton and New river lagoons of the Colorado Desert during seasons of overflowing; but we saw no signs of them at the time of our visit away from the Colorado River in that region.

No signs of beavers were seen by us on Cajon Bonito Creek or the San Bernardino River, terminals of the Yaqui River; but Mr. Hall, who resided in the Guadalupe Canyon, informed me in 1892 that he had seen their cuttings lower down on Cajon Creek; but I failed to discover them there.

Comparative cranial measurements of 27 specimens of beavers.

Museum number of skull.	Locality.	Sex and age.	Condylo-basal length.	Basilar length.	Length of nasals.	Greatest width of nasals.	Interorbital breadth.	Greatest width of skull.	From front of intermaxillaries to lateral teeth.	Palitar length.	From posterior border of palate to foramen magnum.	Maxillary tooth row.	Greatest length of mandible.	Height of mandible from angle to apex of coronoid process.
			mm	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*
2045*a*	Verde River, Arizona	♂ ad.	138	122	47	25	23	102	57.0	79.0	43	30.0	115	61.0
2029*a*	....do	♂ ad.	140	125	48	26	26	100	58.0	90.0	44	32.0	116	59.3
5131*a*	....do	♂ ad.	141	123	53	27	24	101	59.0	92.0	43	32.0	120	60.6
2047*a*	....do	♂ ad.	139	122	50	25	23	97	56.0	86.0	45	31.4	114	63.0
2028*a*	....do	♂ ad.	135	119	46	24	25	97	56.0	87.0	41	31.0	112	59.0
2052*a*	....do	♂ ad.	138	122	50	27	24	97	55.0	86.0	44	31.2	112	56.0
35883	San Pedro River, Sonora, Mexico*b*	♂ ad.	133	117	47	25	23	99	55.1	84.6	40	31.0	108	54.5
60354	Colorado River, Arizona	♂ ad.	134	119	48	25	23	97	54.4	81.0	40	32.2	......	......
2033*a*	Verde River, Arizona	♀ ad.	135	119	47	25	22	95	54.2	85.0	42	30.5	109	56.0
2035*a*	....do	♀ ad.	127	111	44	23	22	92	51.0	80.0	38	29.0	104	54.0
2046*a*	....do	♀ ad.	131	115	48	25	22	94	54.0	83.0	41	29.0	107	55.0
2030*a*	....do	♀ ad.	128	112	48	24	23	92	53.0	82.0	41	29.0	106	54.0
2034*a*	....do	♀ ad.	137	123	49	24	22	100	57.0	79.0	44	31.0	113	59.0
2043*a*	....do	♀ ad.	136	120	50	25	24	101	55.0	72.0	43	31.0	112	57.0
2032*a*	....do	♀ ad.	133	116	46	24	24	96	54.0	75.0	40	30.2	107	54.0
35946	San Pedro River, Sonora, Mexico	♀ ad.	126	111	45	22	22	94	51.2	80.2	39	29.2	104	56.0
4347	Fort Simpson, Hudsons Bay territory		120	105	42	22	23	86	49.0	71.0	35	28.0	99	50.0
4292	....do	♂ ad.	120	106	41	21	22	84	47.0	70.0	36	28.0	95	50.0
4294	....do		116	102	40	20	22	81	45.0	66.0	31	28.0	92	47.0
3280	Nelson River, Hudsons Bay territory		116	102	40	23	22	87	46.0	66.0	34	27.5	97	51.0

7194	Fort Good Hope, Hudsons Bay territory	♂ ad.	120	106	41	21	21	85	47.0	68.0	38	28.0	98	51.0
7195	....do	♂ ad.	122	108	43	22	21	85	51.0	71.0	37	28.0	96	48.0
7392	Lake Superior		123	107	43	22	21	88	50.0	71.0	35	29.0	101	54.0
7389	....do		126	111	44	21	23	89	53.0	76.0	39	29.0	102	55.0
20891	Genito, Virginia		133	117	47	23	26	94	55.0	78.0	40	32.0	107	57.0
3772	Franklin County, Mississippi		134	118	48	24	24	99	54.0	76.0	43	32.0	110	58.0
6561	River Elbe, Germany		125	105	51	23	25	83	50.0	70.0	35	30.0	97	51.0
Average of 8 males from Arizona and Sonora			137	121	49	26	24	99	56.3	85.7	42	31.4	114	59.1
Average of 8 females from Arizona and Sonora			132	116	47	24	23	96	53.7	80.0	41	29.9	108	55.6
Total average of 16 from Arizona and Sonora			134	119	48	25	24	98	55.0	82.9	42	30.7	111	57.4
Average of 10 adults from Canada and the eastern United States			123	108	43	22	23	88	49.7	71.3	37	29.0	100	52.4

[a] American Museum of Natural History.

[b] Type of *C. c. frondator.*

Measurements of 13 specimens of Castor canadensis frondator.[a]

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Length of tail, measured from anus.	Greatest width.	Ear, height above crown.	Length of manus and claw.	Length of pes with claw.	Weight, pounds avoirdupois.
Skin.	Skull.											
				1884.		*mm*	*mm*	*mm*	*mm*	*mm*	*mm*	*mm*
3336	1854	120	Verde River, at Fort Verde, Arizona.	Aug. 16	♂ ad.	1,120	360	125	40	73	143	61
	2055?	122	.....do	Aug. 19	♀ juv.	630	224	63	30	52	99	....
3337	2054?	123	.....do	Sept. 10	♂ juv.	750	253	77	32	57	99	....
				1885.								
3338	....	198	.....do	June 13	♀ juv.	387	122	36	17	41	81	....
(?)	2038	199	.....do	....do...	♂ juv.	390	127	32	17	41	78	....
	5131	262	.....do	Oct. 14	♂ ad.	1,130	365	150	27	83	182	64
	2037	265	.....do	Oct. 17	♂ juv.	800	280	88	29	68	150	....
				1886.								
6785?	5394?	406	Beaver Creek, near Fort Verde, Arizona.	May 28	♀ ad.	1,080	365	155	35	85	185	42
2339	....	407	.....do	....do...	♂ juv.	340	97	.....	.....	.....	.....	....
				1887.								
	2057	515	Verde River, at Fort Verde, Arizona.	Feb. 10	♀ ad.	1,132	385	153	35	85	182	46
	2036?	522	.....do	Feb. 21	♂ juv.	963	318	114	34	76	168	....
20751	35946	2118	San Pedro River, Sonora, Mexico.	1892.....	♀ ad.	950	334	127	25	84	176	32
20750	35883	2151	.....do.[b]	1892.....	♂ ad.	1,070	360	125	31	82	185	62

[a] All but the last two specimens are in the collection of the American Museum of Natural History.

[b] Type.

Family MURIDÆ.

RATS AND MICE.

Dentition.—I. $\frac{1-1}{1-1}$; C. $\frac{0-0}{0-0}$; P. $\frac{0-0}{0-0}$; M. $\frac{3-3}{3-3}=16$.

Skull with contracted frontals; a short and slender jugal, generally reduced to a splint between the zygomatic processes of the maxilla and squamosal; the lower root of the former process more or less flattened into a perpendicular plate; typically, the infraobital vacuity tall, and wide above and narrow below. Lower incisors compressed; no premolars; molars rooted, or rootless, tuberculate, or with angular enamel-folds. Pollex rudimental; tail generally nearly naked and scaly. (*Flower and Lydekker.*)

KEY TO TEN GENERA OF MURIDÆ.[a]

a. Grinding teeth crowned by tubercles or cusps.

b. Grinding teeth with tubercles arranged in three transverse rows, very distinct in teeth of upper jaw...*Mus* (p. 363).

bb. Grinding teeth with tubercles arranged in two longitudinal rows.

c. Upper incisors longitudinally grooved..................*Reithrodontomys* (p. 456).

cc. Upper incisors not grooved.

d. Skull with a distinct ridge over eye-socket; fur coarse; belly not pure white; size larger (total length usually over 130 mm)..................*Oryzomys* (p. 454).

dd. Skull without a prominent ridge over eye-socket; belly pure white; smaller (total length usually under 130 mm).

e. Coronoid process of mandible developed as a long hook; soles of feet hairy.

f. Body stout; size medium to rather large (total length 125 to 175 mm.); plantar tubercles, four; teeth with high tubercles.....*Onychomys* (p. 368).

ff. Body mouse-like; size small (total length less than 100 mm.); plantar tubercles, six; teeth with low tubercles..................*Baiomys* (p. 381).

ee. Coronoid process of mandible developed as a short spine; soles of feet largely naked...*Peromyscus* (p. 382).

aa. Crowns of grinding teeth flattened, and divided into loops or triangles formed by plates of enamel inclosing dentine.

g. Enamel loops S-shaped..........................*Sigmodon* (p. 445).

gg. Enamel loops distinctly triangular.

h. Upper incisors narrow, compressed, the antero-posterior diameter of each much greater than the transverse diameter; body slender; tail always long; eyes and ears large; belly white.............*Neotoma* (p. 467).

hh. Upper incisors broad, the antero-posterior diameter of each less than transverse diameter; body clumsy; tail usually short; eyes and ears small; belly generally not white.

i. Tail flattened laterally.............................*Fiber* (p. 494).

ii. Tail round....................................*Microtus* (p. 498)

Subfamily MURINÆ.

Molars rooted and tuberculated, those of the upper jaw with three longitudinal rows of tubercles. The species existing in the New World have been introduced and naturalized from the Old World.

Genus MUS Linnæus (1758).

Dentition—I. $\frac{1-1}{1-1}$; M. $\frac{3-3}{3-3}=16$.

Front teeth two; cheek teeth never more than three in each jaw. Incisors narrow, without grooves. Structure of molars as in fig. 58. Incisive foramina of skull long; coronoid process of mandible well developed. Ears and eyes rather large. Muzzle naked at the extremity. Fur soft, in some cases mixed with spines.

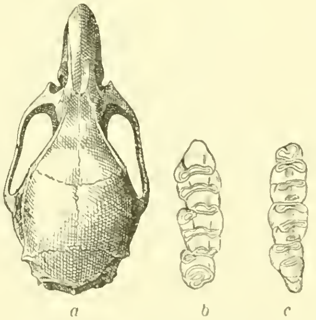

FIG. 58.—MUS ALEXANDRINUS. *a*, Skull; *b*, Upper molars; *c*, Lower molars.

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[a] Largely borrowed from Miller's Key to the Land Mammals of Northeastern North America, in Bulletin of the New York State Museum, VIII, October, 1900, p. 93.

Hind foot (fig. 59) 6-tuberculate; tubercles paired. Pollex with a short nail in place of a claw. No cheek-pouches. Tail long, nearly naked, with rings of overlapping scales. Vertebræ: C 7, D 13, L 6, S 4, C 26-32. (*Flower and Lydekker.*)

This genus is represented by four very distinct species on the Mexican Boundary Line.

KEY TO THE SPECIES OF MUS FOUND ON THE BOUNDARY LINE.

a. Size large. Length more than 300 mm.
  b. Tail about as long as head and body, dusky above and pale below; color of body grayish-brown above, soiled grayish-white below.............. *Mus norvegicus* (p. 364).
  bb. Tail considerably longer than head and body, and dusky all round.
    c. Color reddish-brown above, and white below; pelage mixed with spines. *Mus alexandrinus* (p. 366).
    cc. Color blue-black, darker on the back, more slaty on the belly.. *Mus rattus* (p. 365).
aa. Size small. Length less than 200 mm...................... *Mus musculus* (p. 366).

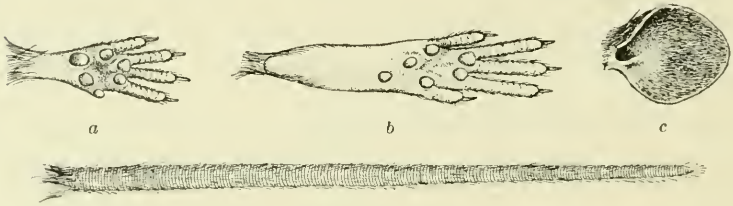

FIG. 59.—MUS MUSCULUS. *a*, FOREFOOT; *b*, HINDFOOT; *c*, EAR; *d*, TAIL.

MUS NORVEGICUS Erxleben.

NORWAY RAT; BROWN RAT; WHARF RAT.

[*Mus*] *norvegicus* ERXLEBEN, Syst. Regni Anim., I, 1777, p. 318 (original description).—ELLIOT, Field Col. Mus., Zool. Ser., IV, 1904, p. 164 (Mam. Mid. Am.).

Mus norvegicus, REHN, Proc. Biol. Soc. Washington, XIII, p. 167, Oct. 31, 1900.—MILLER and REHN, Proc. Bost, Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 65 (Syst. Results Study N. Am. Mam. to close of 1900).

Mus decumanus PALLAS, Glires, 1778, p. 91, No. 40.

[*Mus*] *decumanus*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 117 (Synop. Mam. N. Am.).

Type-locality.—Norway.

Geographical range.—Cities and larger settlements.

Description.—Normal coloration grayish-brown above, dirty grayish-white below; upper surface more or less lined with black hairs, especially in the vertebral area, which is also grayest. Feet soiled grayish-white. Tail dusky above and whitish below, though not distinctly bicolored. Tail usually shorter than head and body, and so sparsely short-haired as to show the annuli plainly.

Remarks.—This cosmopolitan species is found sparingly in the cities of the Southwest. In Arizona and New Mexico the white domestic variety is most common, though brown ones were occasionally seen dead in the streets of El Paso, Nogales, and Tucson, where it appeared to be less numerous than the roof rat (*Mus alexandrinus*). In San Diego, rats were very abundant. Scores of black, white, or, more often, particolored ones, were seen about stables or slaughterhouses, and were said to have been recently imported from China. Among ten specimens collected about the wharves of San Diego, was a single plumbeous-black individual, which agreed in all respects, except color, with eastern specimens of *Mus norvegicus.* The remaining nine had unusually long tails, in some instances longer than the head and body. They were grayer than New York examples of *Mus norvegicus.* Large brown rats, probably this species, were feeding about my camp, in Flagstaff, Arizona, June 1 to 3, 1887. I saw dead Norway rats lying in the streets of Bisbee, Arizona, in October and November, 1892. None were seen or heard of on the Sonoyta River, Sonora, Mexico, no species of *Mus* having reached the Mexican villages of that region.

Record and measurements of 10 specimens of Mus norvegicus.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind-foot.	Ear from crown.
Skin.	Skull.								
				1893.		*mm.*	*mm.*	*mm.*	*mm.*
58846	58846	1101	Fort Lowell, Arizona	Nov. 9	[a] ♀ ad.				
				1896.					
83454	83454	1722	San Diego, California	May 5	[b] ♀ im.	345	174	38.0	15.5
83455	83455	1723	do	May 7	[b] ♀ ad.	422	215	40.0	15.5
83456	83456	1724	do	do	[c] ♀ ad.	393	199	40.0	14.5
83458	83458	1726	do	May 14	[b] ♂ ad.	409	215	43.0	14.0
83459	83459	1727	do	do	[b] ♂ ad.	371	190	42.0	14.5
83460	83460	1728	do	do	[b] ♂ im.	385	202		
83461	83461	1729	do	do	[b] ♂ im.	376	187	41.0	15.0
83462	83462	1730	do	May 18	[d] ♂ ad.	370	171	39.5	18.0
83463	83463	1731	do	May 20	[b] ♂ ad.	391	202	43.0	14.5

[a] Color, white.

[b] Color, brown.

[c] Color, brown. Contained 4 fetuses.

[d] Color, plumbeous-black.

MUS RATTUS Linnæus.

BLACK RAT.

[*Mus*] *rattus* LINNÆUS, Syst. Nat., 10th ed., 1758, p. 61 (original description).—ELLIOT, Field Col. Mus., II, 1901, p. 117, fig. 28 (skull). (Synop. Mam. N. Am.); IV, 1904, p. 163, fig. 31 (skull), fig. 25 (animal) (Mam. Mid. Am.).

Mus rattus, MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 56 (Syst. Results Study N. Am. Mam. to close of 1900).

Type-locality.—Sweden.

Geographical range. Cosmopolitan, but does not thrive where *Mus norvegicus* is abundant, usually disappearing before it.

Description.—Upper parts plumbeous-black; under parts slate color. Total length, 400 mm; tail vertebræ, 215; hind foot, 37.

Habits and local distribution.—We did not meet with the black rat on the Mexican border; but Mr. Herbert Brown, writing from Yuma, Arizona, November 18, 1900, says:

> I find the black rat here. Some time ago I offered to send some live ones to Mr. Hornaday, Central Park, New York, but he did not care for them. They were the first I ever saw in the Territory. In a litter of 4 young ones, 3 were jet black and 1 brown. The brown rat appears to be the more common of the two.

MUS ALEXANDRINUS Geoffroy Saint Hilaire.

ROOF RAT; WHITE-BELLIED RAT.

Mus alexandrinus GEOFFROY SAINT HILAIRE, Descr. de l'Egypte, Mamm., 1818, p. 733, pl. v, fig. 1 (original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 65 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Mus*] *alexandrinus*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 118 (Synop. Mam. N. Am.); IV, 1904, p. 164 (Mam. Mid. Am.).

Type-locality.—Alexandria, Egypt.

Geographical range.—Cities and houses in Tropical and Austral zones.

Description.—Smaller than *Mus norvegicus*, with relatively longer tail and larger ears. Color, reddish brown above, white below. Tail unicolored and considerably longer than head and body.

Remarks.—The roof rat at times appears in abundance in the settlements along the Rio Grande, disappearing again later. We saw them only at El Paso, Nogales, and Tucson, where they were common enough to be troublesome. It is said to be abundant in the towns of the San Pedro and Santa Cruz valleys. It does not extend its range as high as the Transition Zone.

Measurements of a specimen of Mus alexandrinus.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind foot.	Ear from crown.
Skin.	Skull.								
				1893.		*mm.*	*mm.*	*mm.*	*mm.*
21417	36217	2515	Nogales, Arizona	July,1893	♂ ad.	390	200	35	15

MUS MUSCULUS Linnæus.

HOUSE MOUSE.

[*Mus*] *musculus* LINNÆUS, Syst. Nat., 10th ed., I, 1758, p. 62 (original description).—ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 118 (Synop. Mam. N. Am.); IV 1904, p. 162 (Mam. Mid. Am.).

Mus musculus, MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 65 (Syst. Results Study N. Am. Mam. to close of 1900).

Oo-wa'-g of the Hualapai Indians.

Put'-cha or *Ho-micht'se* of the Hopi Indians.

Type-locality.—Sweden.

Description.—Size small. Length, 180 mm.; tail vertebræ, 85; hind foot, 19; ear from notch, 15. Color, brownish gray above, paler (sometimes pinkish) below. Mammæ, 4 (often 5) pairs. Iris dark brownish gray.

Remarks.—Found in greater or less abundance in all of the settlements of the Southwest. In addition to the localities from which specimens are listed, I have seen the house mouse in Prescott, Arizona, in 1884, at Phoenix in 1885, and at Flagstaff, Arizona, on June 20, 1886. None were seen or heard of in the Mexican towns on the Sonoyta River, in the State of Sonora, Mexico.

Record and measurements of 19 specimens of Mus musculus.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Length of hind foot.	Ear from crown.
Skin.	Skull.								
				1893.		*mm.*	*mm.*	*mm.*	*mm.*
21186	37179	2268	Fort Clark, Kinney County, Texas.	Feb. 5	♀ im.	159	80	19.0	10.0
21055	36097	2340	Fort Hancock, El Paso County, Texas.	June 15	[a] ♀ ad.	185	91	20.0	12.5
21054	36096	2341	.....do.....................	June 16	[b] ♀ ad.	184	90	20.0	12.5
21056	36098	2342	.....do.....................	...do...	[c] ♀ ad.	184	86	20.0	12.5
				1892.					
20087	37225	1444	El Paso, Texas..................	Feb. 16	♂ im.	161	79	19.0	10.0
20085	35454	1504	.....do.....................	Feb. 24	♀ ad.	176	89	18.0	12.0
20084	35453	1505	.....do.....................	...do...	♂ im.	168	83	19.0	10.5
20086	35455	1506	.....do.....................	...do...	♂ ad.	182	87	18.5	12.0
				1893.					
58835	58835	2584	Town of Santa Cruz, Sonora.....	Oct. 22	[b] ♀ ad.	180	85	18.5	12.0
58836	58836	2614	.....do.....................	Oct. 23	♂ im.	155	74	18.0	10.3
58837	58837	2615	.....do.....................	...do...	[d] ♀ ad.	170	80	18.5	11.5
58834	58834	2652	Tucson, Arizona..................	Nov. 1	[b] ♀ ad.	180	86	18.5	11.5
				1884.					
2385[e]	In skin	109	Fort Verde, Arizona..........	July 13.	♂ ad.	175	90	18.0	14.0
2386	In skin.	132	.....do.....................	Sept. 21	♀ juv.	172	92	......	......
				1885.					
......	1818	270	.....do.....................	Oct. 22	♂ ad.	180	96	20.5	11.0
				1891.					
60175	60175	3104	Yuma, Arizona..................	Mar. 8	♂ ad.	158	78	19.0	10.7
61002	61002	3592	Jacumba, San Diego County, California.	May 28	♂ juv.	......	......	......	......
				1895.					
......	......	1717	Rose Canyon, San Diego County, California.	Aug. 15	♂ juv.	150	79	......	......
......	......	1666	.....do.....................	Aug. 10	♀ ad.	190	100	......	......

[a] Mammæ, 4 pairs.
[b] Mammæ, 5 pairs.
[c] Mammæ, 5 pairs. Iris dark, brownish gray.
[d] Strongly yellowish. Mammæ, 5 pairs.
[e] American Museum of Natural History.

Subfamily CRICETINÆ.

Grinding teeth rooted and either flattened (in the genera *Sigmodon*, *Neotomys*, etc.) or tuberculated (*Onychomys*, *Baiomys*, *Peromyscus*, *Oryzomys*, *Reithrodontomys*, etc.). When tuberculate, the tubercles are arranged in two longitudinal rows.

Genus ONYCHOMYS Baird (1857).[a]

Onychomys Baird, Mam. N. Am., 1857, p. 457 (subgenus).—Merriam, North American Fauna, No. 2, 1889, p. 3, text figs. 1 and 2 (raised to generic rank).

Dentition.—I. $\frac{1-1}{1-1}$; M. $\frac{3-3}{3-3} = 16$.

Type—Hypudæus leucogaster Max. zu Wied.[b]

Similar to *Peromyscus*, except as follows: Body stout; pelage dense; tail short, thick, and usually all white at the end: ears small and hairy; fore feet large; hind feet with only four tubercles, all phalangeal; nasal bones wedge-shaped, ending, posteriorly, well behind the nasal processes of the premaxillaries; coronoid process of mandible developed as a long hook; dentition heavy, but with last upper molar disproportionately small; dental tubercles high; most closely allied to the subgenus *Trinodontomys* of *Peromyscus*.

The seven forms of the genus *Onychomys* known to inhabit the Mexican Border may be considered as forming two groups, one containing three large forms, which resemble *O. leucogaster*, the other four small forms resembling *O. torridus*. Hence they may be conveniently designated, respectively, the *leucogaster* group, and the *torridus* group. The four components of the latter are distributed continuously from near the Pecos River, Texas, to the Pacific Ocean, the former having an interrupted distribution between the Gulf of Mexico and the Santa Cruz Valley, of Arizona and Sonora. The four members of the *torridus* group are known to be intergrading geographical races of a common species, but the relationship of the three members of the *leucogaster* group to each other and to *O. leucogaster* are not plain, because the three are separated by considerable areas in which no specimens have been taken, and no specimens exhibiting intermediate characters have yet been recorded. It seems to be desirable, therefore, at present to consider the three larger forms as species. The four small forms are evidently subspecies of *Onychomys torridus* Coues.

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[a] Of all our murine genera, *Onychomys* is preeminently carnivorous and largely insectivorous; hence the appropriateness of the names grasshopper mice and scorpion mice, which have obtained a foothold in vernacular nomenclature of late. The name grasshopper mice, by usage, and because of its general applicability, is to be preferred. Dr Elliott Coues, in the monographs of Rodentia, has styled the members of this genus mole-mice, a not inappropriate name, which the dense pelage, short, thick tail, and strongly developed feet of these animals may have suggested; but the name mole-rat, having long been in use for certain Old World rodents, naming our *Onychomys* mole-mice might lead to confusion.

[b] Reise das innere Nord Amerika, II, 1841, pp. 99–101 (from Fort Clark, Dakota).

KEY TO EIGHT SPECIES AND SUBSPECIES OF ONYCHOMYS.

a. Size large. Length, more than 150 mm; total length of skull, about 30 mm.
  b. Size largest. Length, about 170 mm; tail vertebræ, 57; hind foot, 24. Color above, mouse-gray .... *Onychomys longipes* (p. 369.)
  bb. Size smaller. Length, about 160 mm; tail vertebræ, 50; hind foot, 22.
    c. Coloration very pale. Color above, pale tawny-cinnamon. *Onychomys pallescens* (p. 371).
    cc. Coloration dark.
      d. Color above, blackish slate (extralimital) .... *Onychomys fuliginosus.*
      dd. Color above, tawny-cinnamon .... *Onychomys melanophrys* (p. 372).
aa. Size small. Length, less than 150 mm; total length of skull, about 25.5 mm.
    e. Coloration dark.
      f. Color above, tawny-cinnamon .... *Onychomys torridus* (p. 374).
      ff. Color above, dark-grayish drab or mouse-gray. *Onychomys torridus ramona* (p. 379).
    ee. Coloration very pale.
      g. Size smallest. Length, about 137 mm; tail vertebræ, 53; ear from crown, 14; hind foot, 21. Skull, 25.5 by 13.5 mm. Color above, pale grayish drab .... *Onychomys torridus arenicola* (p. 377).
      gg. Larger. Length, about 154 mm; tail vertebræ, 56; ear above crown, 15; hind foot, 21.5. Skull, 25.5 by 13.5 mm. Color above, pale drab-gray .... *Onychomys torridus perpallidus* (p. 378).

ONYCHOMYS LONGIPES Merriam.

TEXAS GRASSHOPPER MOUSE.

Onychomys longipes MERRIAM, North American Fauna, No. 2, Oct. 30, 1889, pp. 1, 2, 4, and 5 (original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 66 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Onychomys leucogaster*] *longipes*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 120 (Synop. Mam. N. Am.).

Type-locality.—Concho County, Texas. (Type, skin and skull, No. $\frac{3207}{3839}$, collection of Dr. C. Hart Merriam.)

Geographical range.—Texas. Inhabits the Sonoran Zone from the Gulf of Mexico west to Kinney County (Fort Clark) and north to Fort Sill, Indian Territory (Dr. J. C. Merrill).

Description.—Size, large (about the same as *O. melanophrys*). Length, 170 mm.; tail vertebræ, 57 (to end of pencil, 61); ear, above crown, 14.5; ear above notch, 18; length of hind foot, 23.5. Skull, 30 by 15.5; Coloration, dark; above, grayish drab, tinged with cinnamon and mixed with black in the form of fine annulations and points to the hairs, and with a narrow stripe of dull cinnamon along each side, between the drab of the back and the white of the belly. Under parts, feet, tip, and under side of tail, white. Ears dusky, with a mixture of hoary at the tips, a black spot on the anterior border of their outer surface, and with the woolly tuft at base, which is usually white in *Onychomys*, mixed with fulvous. Tail with a dorsal stripe of drab extending nearly to the end. Young, smoke-gray, varying to mouse-gray with age.

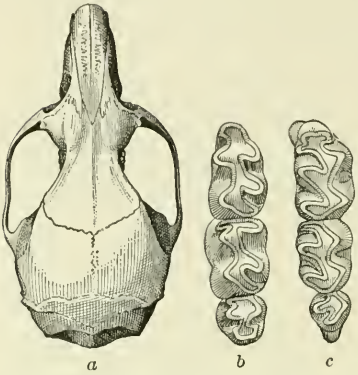

FIG. 60.—ONYCHOMYS LONGIPES. *a*, SKULL; *b*, LOWER MOLARS; *c*, UPPER MOLARS.

Cranial and dental characters.—The skull (fig. 60*a*) of this species is heavy and has the supraorbital ridges developed as an appreciable beading. Compared with *Onychomys pallescens* and *O. melanophrys*, it is perceptibly narrower. The interpterygoid fossa appears to be slightly longer. Altogether the skulls and teeth of these three forms—*longipes* (figs. 60*b* and *c*), *pallescens*, and *melanophrys*—are quite similar, which fact leads to the supposition that they may ultimately prove to be but geographic races of a common species. The rostrum and nasals of *longipes* are slightly shorter than in *pallescens*, the adjoining form on the west.

Measurements of 8 specimens of Onychomys longipes.

Museum number.		Collectors' number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Length of hindfoot (including claw).	Ear from crown.
Skin.	Skull.								
				1893.		*mm.*	*mm*	*mm.*	*mm.*
21183	37006	2183	Fort Clark, Kinney County, Texas...	Jan. 1	♂ ad.	173	57	23.3	14.0
21182	37007	2232	.....do.....	Jan. 17	♂ ad.	168	58	24.0	15.0
				1892.					
21180	37003	2173	.....do.....	Dec. 29	♂ ad.	167	55	23.0	14.5
21185	37004	2177	.....do.....	Dec. 31	♀ ad.	163	53	23.0	16.0
21179	37005	2176	.....do.....	Dec. 30	♂ juv.	156	54	20.5	12.0
21194	....	2275	.....do.....	Feb. 6	♂ im.	161	55	22.7	15.0
21184	....	2179	.....do.....	Dec. 31	♀ juv.	141	50	22.5	13.3
21181	....	2178	.....do.....	....do...	♀ juv.	141	50	22.0	14.5

ONYCHOMYS PALLESCENS (Merriam).

EASTERN DESERT GRASSHOPPER MOUSE.

Onychomys melanophrys pallescens MERRIAM, North America Fauna, No. 3, Sept. 11, 1890, pp. 61, 62 (original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 67 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Onychomys leucogaster*] *pallescens* ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 121 (Synop. Mam. N. Am.).

O[*nychomys*] *m*[*elanophrys*] *pallescens*, ELLIOT, Field Col. Mus., Zool. Ser., IV, 1904, pp. 165 and 166 (Mam. Mid. Am.).

Raton of the Mexicans.

Type-locality.—Hopi pueblos, Apache County, Arizona. (Type, skin and skull, No. $\frac{4252}{4983}$, collection of Dr. C. Hart Merriam.)

Geographical range.—Sonoran zone of the desert basins of the upper Rio Grande and Little Colorado rivers—the Eastern Desert Tract.

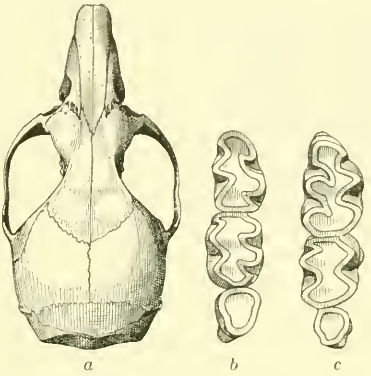

FIG. 61.—ONYCHOMYS PALLESCENS. *a* SKULL; *b*, LOWER MOLARS, *c*, UPPER MOLARS.

Description.—Smaller than *O. longipes* or *O. melanophrys*. Average measurements of six adults: Length, 159 mm.; tail vertebræ, 51 (to end of pencil, 54); ear above crown, 15; ear above notch, 18.5; length of hind foot, 23. Skull (fig. 61*a*), 30 by 16. Coloration, very pale; above, pale annulated hairs, becoming paler and grayish on the head and brighter tawny cinnamon, but slightly mixed with black-tipped and black cinnamon on the flanks and rump; palest specimens, light fawn color or écru drab above; under surface, feet, and end of tail white; ears buffy white, with a large seal-brown spot on anterior border of convex surface and conspicuous lanuginous tufts at anterior base; dusky stripe on upper side of tail, obsolete. Mammæ: P$\frac{1}{1}$, A. $\frac{0}{0}$, I. $\frac{2}{2}$=3 pairs.

This desert mouse was found by us only from El Paso, Texas, to the Mimbres Valley, near Monument No. 15 of the boundary. From that point westward to the San Bernardino Valley, at Monument No. 77, we found no large species of *Onychomys*. The San Bernardino form, which we refer to *O. melanophrys*, is the darkest of the group, excepting *Onychomys fuliginosus* Merriam, from the piñon and cedar belt and the black lava beds between San Francisco Mountain and the desert of the Little Colorado, which has a dark, almost blackish, coloration, unique in the genus.

Remarks.—Compared with the type of *pallescens*, our specimens from the Rio Grande Valley, at El Paso, are paler—almost écru drab.

A specimen of this species (No. $\frac{3209}{9}$, U.S.N.M.) was collected many years ago at El Paso, Texas, and forwarded by Col. J. D. Graham to Professor Baird, who included it in his "list of specimens" of "*Hesperomys sonoriensis* Le Conte."

Habits and local distribution.—Seven were trapped in the vicinity of Monuments 1 and 15. No others were seen. One taken at Monument No. 15 had its stomach packed full of scorpions.

Record and measurements of 7 specimens of Onychomys pallescens.

Museum number. Skin.	Museum number. Skull.	Collectors' number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Length of hindfoot (including claw).	Ear from crown.
				1892.		*mm.*	*mm.*	*mm*	*mm.*
20079	35450	1468	El Paso, Texas, near Monument No 1	Feb. 19	♀ ad.	166	50	24.0	15.0
20080	35451	1475	....do....	Feb. 20	♂ ad.	160	49	23.0	16.0
21225	37009	1576	Monument No 15, 50 miles west of El Paso Texas	Mar. 24	♂ ad.	161	55	23.0	16.0
21223	37008	1567	....do....	Mar. 23	♀ ad.	150	47	21.0	14.0
21226	37021	1582	....do....	Mar. 25	♀ ad.	......	......	......	......
21224	37010	1597	....do....	Mar. 29	♀ ad.	157	50	22.0	15.5
21222	......	1633	....do....	Apr. 4	♀ ad.	159	54	24.0	15.0

ONYCHOMYS MELANOPHRYS (Merriam).

BLACK-EYED GRASSHOPPER MOUSE.

Onychomys leucogaster melanophrys Merriam, North American Fauna, No. 2, Oct. 30, 1889, pp. 2-5 (original description).

O[nychomys] melanophrys, Merriam, North American Fauna, No. 3, Sept. 11, 1890, p. 61.—Elliot, Field Col. Mus., Zool. Ser., IV, 1904, pp. 165, 166 (Mam. Mid. Am.).

Onychomys melanophrys, Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 67 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Onychomys leucogaster*] *melanophrys*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 120 (Synop. Mam. N. Am.).

Type-locality.—Kanab, Utah. (Type, skin and skull, No. $\frac{10183}{12453}$, U. S. National Museum.)

Geographical range.—High central region, from Utah to the Mexican border; Sonoran areas, near streams.

Description.—Size large; the stoutest and heaviest species of *Onychomys* known, though falling a little below the measurements of *O. longipes*, which is more slender. Average measurements of six adults: Length, 163 mm.; tail vertebræ, 52 (to end of pencil, 56); ear above crown, 14.7; ear above notch, 18.2; length of hind foot, 22.5. Skull, 29 by 16 mm. (For teeth see fig. 62.) Color above, dull tawny cinnamon well mixed with black-tipped hairs on the back, and brightest on the sides and rump; eye encircled by a narrow black ring; under parts, feet, and end of tail, pure white; tail with a dark drab stripe on basal three-fourths of upper side; ears dusky, mixed with hoary apically, with a black spot on anterior border of outer surface, and with lanuginous tufts inconspicuous.

The foregoing description is based on specimens from the Mexican border, on the San Pedro River, Arizona. A series of more than thirty was obtained from that general region (San Pedro and Santa Cruz valleys) and from the Verde Valley in central Arizona. These specimens represent the extreme degree of development of the form described from Utah, which Doctor Merriam has named *melanophrys*, and differ from the type in being larger and darker, with the upper surface duller, more grayish drab, with the flanks and rump less tawny cinnamon.

Half-grown young are smoke gray, with hoary tips to the ears and a black spot on their anterior band. They are almost indistinguishable from the young of *O. longipes*, though a trifle paler. When three-fourths grown the coloration is very similar to that of the gray phase of *Peromyscus texanus*. Young adults are dull drabish, without the bright cinnamon tint of adults. The changes of color dependent upon the several stages of age and molt may be graded as follows: (1) Gray, fading later to smoke gray; (2) drab gray, (3) broccoli brown, (4) dull tawny cinnamon.

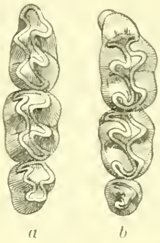
FIG. 62. ONYCHOMYS MELANOPHRYS. *a*, LOWER MOLARS; *b*, UPPER MOLARS.

Remarks.—As usual, the form of this species from the San Bernardino Valley (Monument No. 77) is much darker than elsewhere on the Mexican line, and may represent a distinct geographical race in the Yaqui Valley.

Habits.—Like the other species of *Onychomys*, the black-eyed grasshopper mouse likes open country, where it digs its burrows straight down into the level ground, or, more often, selects a little bank, such as the side of a ditch or arroyo, and digs a slanting burrow. At Fort Verde the gardeners sometimes opened their nests when plowing; and on one such occasion a mother ran out with four small young attached to her teats. Aside from similar accidents, I have never seen one out of its burrow during the daytime, and suppose this mouse to be strictly nocturnal.

Measurements of 23 specimens of Onychomys melanophrys.

Museum number.		Collectors' number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Length of hindfoot (including claw).	Ear from crown.
Skin.	Skull.								
						mm.	*mm.*	*mm.*	*mm.*
......	......	154	Fort Verde, Central Arizona	1884. Dec. 7	♂ ad.	176	51	22.0	16.0
......	......	387	....do	1886. Apr. 15	♀ ad.	163	52	22.0	15.5
21218	36154	2143	San Pedro River, Mexican Boundary Line.	1892. Oct. 22	♂ ad.	174	57	23.5	15.0
21227	37140	2144	....do	....do...	♂ ad.	170	54	23.0	15.0
21220	36156	2153	....do	Oct. 24	♂ ad.	161	48	22.0	14.0
21217	36153	2158	....do	Oct. 26	♀ ad.	159	54	22.5	16.5
21210	36147	2136	....do	Oct. 17	♀ ad.	163	52	22.0	14.5
21216	36152	2127	....do	Oct. 15	♀ ad.	153	45	22.0	13.3
21221	36157	2156	....do	Oct. 25	♀ im.	145	50	20.5	15.0
21215	36151	2155	....do	....do...	♀ im.	151	57	21.0	13.5
21191	36140	2149	....do	Oct. 23	♂ im.	150	48	22.0	14.0
21193	36142	2137	....do	Oct. 17	♂ im.	145	46	22.0	13.0
21192	36141	2159	....do	Oct. 26	♂ juv.	145	51	22.0	15.0
21249	36159	2145	....do	Oct. 22	♀ juv.	132	40	21.0	......
21209	37020	2078	San Bernardino Valley at Monument No. 77.	Aug. 29	♂ juv.	149	54	22.5	15.0
21207	36145	2132	San Pedro River, Mexican Boundary Line.	Oct. 16	♀ im.	136	45	21.0	15.0
21211	36148	2157	....do	Oct. 25	♀ juv.	137	44	21.0	13.0
20611	35771	761	....do	....do...	♀ im.	146	50	22.0	15.0
20642	35939	782	La Noria, Santa Cruz River, Monument No. 111.	Nov. 10	♀ im.	142	45	20.0	15.0
20719	35866	837	....do	Nov. 25	♀ ad.	141	45	21.0	16.0
20718	35865	816	....do	Nov. 27	♀ ad.	143	48	20.0	14.5
20720	35867	818	....do	Nov. 28	♂ ad.	140	45	20.5	13.5
20788	35889	865	Lochiel P. O., Pima County, Arizona.	Dec. 5	♀ ad.	157	48	20.0	14.0

ONYCHOMYS TORRIDUS (Coues).

ARIZONA GRASSHOPPER MOUSE.

Hesperomys (*Onychomys*) *torridus* Coues, Proc. Acad. Nat. Sci. Phila., 1874, p. 183 (original description); Monogr. N. Am. Rodentia, 1877, pp. 109-111.

[*Onychomys*] *torridus*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 122 (Synop. Mam. N. Am.).

Onychomys torridus, Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 67 (Syst. Results Study N. Am. Mam. to close of 1900).—Elliot, Field Col. Mus., Zool. Ser., IV, 1904, pp. 165-167, fig. 32 (skull) fig. xxxvi (animal) (Mam. Mid. Am.).

Type-locality.—Old Camp Grant, Graham County, Arizona. (Type, skin, Cat. No. 9886, U. S. National Museum.)

Geographical range.—Sonoran Zone of the Elevated Central Tract.

Description.—Size and proportions intermediate between those of *Onychomys torridus arenicola* and *O. t. perpallidus*. Pelage dense and beautifully soft and lustrous. Color above cinnamon, slightly grayish, considerably darkened above by black annuli and tips to the hairs, and inclining to ochraceous on the sides. Ears with lanuginous white tufts at their anterior base; well clothed with whitish hair with a black spot on the anterior half of their convex surfaces. Feet (fig. 63*a* and *b*), under parts, and end of tail white. Tail (fig. 63*c*) densely hairy, with a dark line of drab, mixed with hoary tips to the hairs, on upper side of basal two-thirds. Whiskers long, reaching past the shoulder; their color, mixed black and white. The measurements are shown in the accompanying table.

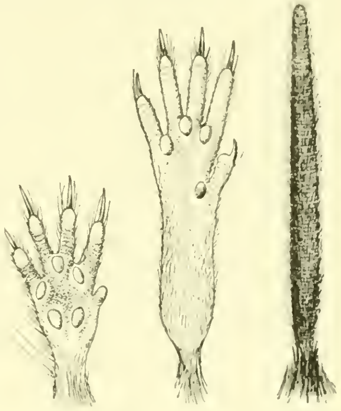

FIG. 63.—ONYCHOMYS TORRIDUS. *a*, FOREFOOT; *b*, HINDFOOT; *c*, TAIL (NAT. SIZE).

There are but three individuals in the series of twenty-two specimens before me which are in the gray pelage of the young. Two of these, about two-thirds grown, taken May 29 and September 18, are gray above and white below, with the usual black spot on the anterior band of the ear. Both are in summer pelage, with the gray underfur showing between the hairs of the sparse coating of the under surface. The third specimen, taken November 23, is in winter pelage and somewhat older, with the sides tinted with drab. The pelage is white below and very dense. The shade of gray is darker in young specimens of the subspecies *torridus* than in *arenicola* or *perpallidus*, but considerably paler than in the subspecies *ramona*, from the Pacific coast.

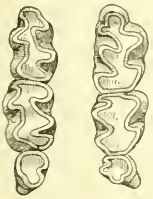

FIG. 64.—ONYCHOMYS TORRIDUS. *a*, LOWER MOLARS; *b*, UPPER MOLARS.

Seasonal variation of adults.—There is very little seasonal difference in coloring. Specimens taken in April, May, and June are colored almost exactly like those captured during November and December. Perhaps the latter are a trifle more grayish or silvery, with the fur more dense and glossy.

Cranial and dental characters.—The skull, except for its smaller size, closely resembles that of *Onychomys melanophrys*. It measures 25.7 by 13.6 mm. (For teeth see fig. 64.)

Remarks.—In coloration the subspecies *torridus* agrees very closely with *O. melanophrys*, which has a similar geographical distribution. Similarly, *O. torridus arenicola* is the analogue of *O. pallescens*. We obtained specimens of this subspecies from the Carrizalillo Mountains west to La Osa (Monuments 32 to 140 of the Mexican Boundary Line.)

This species, including its several geographic forms, ranges along the Mexican line from the Pacific Ocean to the Rio Grande, at El Paso, Texas, and perhaps as far eastward in Texas as the Pecos River. In the north its range extends at least to St. George, Utah, from which locality Doctor Merriam has described a subspecies *longicaudus*. On the boundary strip its environmental conditions have caused it to assume four well-marked geographical phases, each occupying a definite and considerable area. The type locality of typical *Onychomys torridus* is old Camp Grant, Arizona. This locality is characterized by the darker forms of the high interior region. To the eastward, in the desert basins of the upper Rio Grande, a small, short-eared, pale subspecies *arenicola* is found. To the westward, another desert phase (subspecies *perpallidus*), of larger size, with a larger tail, larger ears, and still paler coloration, occupies the Colorado and Yuma deserts of the lower Colorado Valley. The Pacific coast strip is the home of the dark subspecies *ramona*.

Measurements of 18 specimens of Onychomys torridus.

Museum number.		Collectors' number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Length of hindfoot (including claw).	Ear from crown.
Skin.	Skull.								
				1892.		*mm.*	*mm*	*mm.*	*mm.*
21204	37012	1685	Monument No. 40, upper corner, 100 miles west of the Rio Grande.	Apr. 24	♂ ad.	143	53	22.0	13.5
21202	37016	1722	.....do	May 1	♂ ad.	139	49	21.0	12.5
21197	......	1727	.....do	May 2	♂ ad.	139	50	21.0	12.0
21280	37017	1743	.....do	May 7	♂ ad.	134	47	20.0	14.0
21195	37018	1747	.....do	May 8	♂ ad.	139	47	21.0	13.0
21201	37019	1795	Mosquito Springs, Monument No. 45.	May 12	♂ ad.	146	59	20.0	14.0
21214	37011	1669	Carrizalillo Springs, near Monument No. 32.	Apr. 17	♀ ad.	147	57	21.0	13.5
21200	37013	1699	Monument No. 40, upper corner, 100 miles west of the Rio Grande.	Apr. 26	♀ ad.	139	50	21.0	13.5
21198	37014	1718	.....do	Apr. 30	♀ ad.	137	47	22.0	13.0
21199	37015	1721	.....do	May 1	♀ ad.	152	53	20.5	13.5
21203	......	1728	.....do	May 2	♀ ad.	138	56	22.0	14.0
21205	......	1759	.....do	May 11	♀ ad.	143	51	21.5	13.0
				1893.					
21428	36289	876	.....do	June 5	♂ ad.	140	52	20.0	......
......	36381	877	La Osa, Pima County, Arizona	...do	[a] ♀ ad.	146	54	20.5	16.5
21429	36290	878	Santa Cruz River at Monument No. 118.	...do	[a] ♀ ad.	146	55	21.0	17.0
59210	59210	2675	La Osa, Pima County, Arizona	Dec. 13	♀ ad.	139	56	21.0	13.0
59208	59208	2683	.....do	Dec. 14	♂ ad.	136	52	24.0	15.0
59209	59209	2729	.....do	Dec. 24	♀ ad.	150	54	22.0	13.0

[a] Mammæ, 4 pairs (Holzner).

ONYCHOMYS TORRIDUS ARENICOLA Mearns.

EL PASO GRASSHOPPER MOUSE.

Onychomys torridus arenicola MEARNS, Proc. U. S. Nat. Mus., XIX, 1896, p. 139 (p. 3 of advance sheet issued May 25, 1896; original description). MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, Dec. 27, 1901, p. 67 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Onychomys torridus*] *arenicola*. ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 122 (Synop. Mam. N. Am.).

O[*nychomys*] *t*[*orridus*] *arenicola*. ELLIOT, Field Col. Mus., Zool. Ser., IV, 1904, pp. 165, 168 (Mam. Mid. Am.).

Type-locality.—Bank of the Rio Grande, about 6 miles above the town of El Paso, Texas. (Type, skin and skull, Cat. No. $\frac{20081}{35183}$, U. S. National Museum.)

Geographical range.—Sonoran Zone of the Eastern Desert Tract.

Description.—Slightly smaller than typical *Onychomys torridus*, with relatively smaller ears and a much paler coloration. Above pale grayish drab, with little mixture of black-tipped hairs; inclining to fawn color on sides with a conspicuous tuft of white at anterior base of ear; dark spot on anterior band of ear, dark drab instead of black; whiskers more white than black. Under parts, feet, and end of tail white; basal two-thirds of upper side of tail drab, some of the hairs with hoary tips. Length, 137 mm.; tail vertebræ, 53 (to end of pencil, 57); ear from crown, 14; ear from notch, 17; length of hind foot, 21. Skull (fig. 65), 25.5 by 13.5.

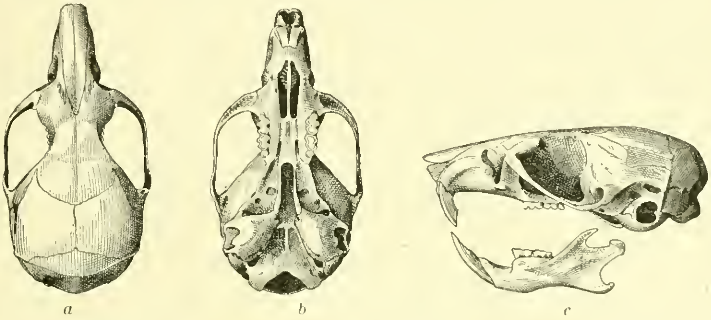

FIG. 65.—ONYCHOMYS TORRIDUS ARENICOLA. SKULL OF TYPE. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

Remarks.—This is the counterpart of *O. pallescens*, of which it is a miniature. The two are almost indistinguishable in color, and their ranges are probably coincident. The specimens of this species taken west of the Rio Grande, for the first hundred miles, are small eared, but otherwise closely resemble typical *torridus*, to which they are unhesitatingly referred. Specimen No. $\frac{1582}{1448}$, U. S. National Museum, an example of this form, was included by Professor Baird in his "list of specimens of *Hesperomys texanus*." This specimen was collected by Doctor Kennerly between the Pecos River and the Rio Grande.

Measurements of type of Onychomys torridus arenicola.

Museum number.		Collectors' number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Length of hindfoot (including claw).	Ear from crown.
Skin.	Skull.								
				1892.		*mm.*	*mm.*	*mm.*	*mm.*
20081	35483	1528	Near El Paso, Texas	Feb. 29	♂ ad.	137	53	21.0	14.0

ONYCHOMYS TORRIDUS PERPALLIDUS Mearns.

YUMA GRASSHOPPER MOUSE.

Onychomys torridus perpallidus Mearns, Proc. U. S. Nat. Mus., XIX, 1896, p. 140 (p. 4 of advance sheet issued May 25, 1896; original description).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 67 (Syst. Results Study N. Am. Mammals to close of 1900).

[*Onychomys torridus*] *perpallidus*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 122 (Synop. Mam. N. Am.).

O[*nychomys*] *t*[*orridus*] *perpallidus*, Elliot, Field Col. Mus., Zool. Ser., IV, 1904, pp. 165, 168 (Mam. Mid. Am.).

Type-locality.—Left (east) bank of the Colorado River, at Monument No. 204. (Type, skin and skull, Cat. No. 60174, U. S. National Museum.)

Geographical range.—Lower Sonoran Zone of the Western Desert Tract.

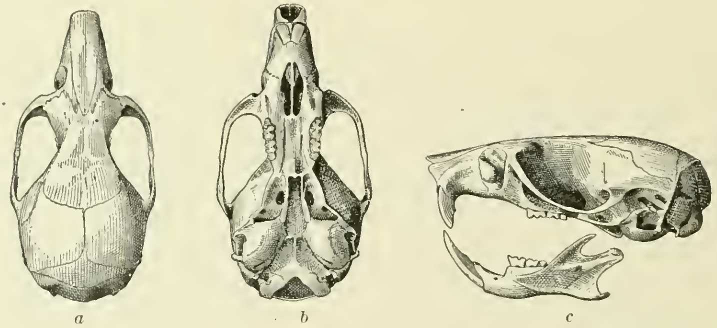

Fig. 66.—Onychomys torridus perpallidus. Skull of type. *a*, Dorsal view; *b*, Ventral view; *c*, Lateral view.

Description.—Slightly larger than typical *Onychomys torridus*, with relatively larger ears and longer tail, and a much paler coloration. Color above drab-gray, becoming more cinereous anteriorly; sides and rump barely tinged with fawn color; dusky line on basal three-fourths of upper side of tail much obscured by whitish hairs; ears less densely clothed than in the other subspecies of *O. torridus*, and without a well-defined dusky spot; whiskers mostly white or colorless;

under surface, feet, and end of tail, white. Average measurements of two adult females: Length, 154 mm.; tail vertebræ, 56.5; ear from crown, 15; length of hind foot, 21.3. Skull (fig. 66), 26.3 by 13.5.

A young male (No. 60815, U.S.N.M.), about two-thirds grown, taken at Seven Wells, on the Colorado Desert, in Lower California, measured 128 mm. in length, with the tail vertebræ 50, ear from crown 14, and hind foot 21. Above, it is smoke gray. The ear shows a distinct dusky spot of mouse gray, and the terminal third of the tail is all white.

Measurements of 5 specimens Onychomys torridus perpallidus.

Museum number.		Collectors' number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Length of hindfoot (including claw).	Ear from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
141850	141850	3070	Gila City, Yuma County, Arizona...	Mar. 2	♀ juv.	135	50	20.0	13.5
141849	141849	3081	.....do................................	Mar. 3	♀ juv.	120	46	......	......
61520	61520	3099	.....do................................	Mar. 5	[a] ♀ ad.	151	56	20.5	14.0
60174	60174	3301	Colorado River at Monument No.204	Mar. 27	[b] ♀ ad.	157	57	22.0	16.0
60815	60815	1144	Seven Wells, Lower California, Mexico	Apr. 16	♂ juv.	128	50	21.0	14.0

[a] Contained 4 large fetuses.

[b] Type.

ONYCHOMYS TORRIDUS RAMONA (Rhoads).

RAMONA GRASSHOPPER MOUSE.

Onychomys ramona RHOADS, American Naturalist, XXVII, p. 833, Sept., 1893 (original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 67 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Onychomys*] *ramona*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 121 (Synop. Mam. N. Am.).

O[*nychomys*] *ramona*, ELLIOT, Field Col. Mus., Zool. Ser., IV, 1904, pp. 165, 167 (Mam. Mid. Am.).

Description. Size of typical *Onychomys torridus* but very much darker in color. Proportions about the same as those of *torridus*. Upper surface drab, tinged with cinnamon on sides, and much mixed with black on top of head and vertebral area; lanuginous tufts at base of ear soiled grayish white; ears blackish, edged with white apically; upper side of tail blackish nearly to the tip; whiskers mostly black; under surface, feet, and extreme tip of tail, white. Average measurements of two adults, male and female: Length, 143 mm.; tail vertebræ, 51.5; ear above crown, 14; length of hind foot, 20.5. Skull, 25 by 13.

Two gray-pelaged young, collected by Mr. Holzner, May 21 and 25, at the foot of the Santee Mountains, San Diego County, California, have the upper surface mouse gray, and the ears nearly black. They are the darkest specimens seen of this species.

Remarks.—The above description, based on specimens from the western part of San Diego County, near the Pacific Ocean, in southern California, reflects the extreme characters of the dark littoral race of *Onychomys torridus* which Mr. Rhoads has named *ramona;* but Rhoads's description was based on the larger and paler inland form, taken in the San Bernardino Valley, California—a region whence he and Dr. Merriam have described several other intergrades between the races of the Colorado Desert and Pacific coast regions, which should not have received names, unless it can be shown that these intermediates are identical with the forms of the great interior valley of California, an area of sufficient importance to merit recognition as a mammal differentiation tract; but, even in this case, the selection of the San Bernardino Valley instead of the San Joaquin Valley as the type locality is unfortunate. In the case of *Onychomys torridus ramona,* the type, fortunately, bears a closer resemblance to the coast form than to that of the Colorado Desert, and the name *ramona* can, therefore, be applied to the Pacific coast form.

Measurement of 13 specimens of Onychomys torridus ramona.

Museum number.		Collectors' number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Length of hindfoot (including claw).	Ear from crown.
Skin.	Skull.								
(a)	(a)	1367	Jacumba Hot Springs, San Diego County, California.	1894. May 29	[b] ♀ ad.	145	50	20.0	14.0
63416	63416	1646	Santee Mountains, San Diego County, California.	1895. May 26	[c] ♂ ad.	141	53	21.0	14.0
63415	63415	1629	....do....	May 21	[c] ♂ juv.	115	44	......	......
1415	(d)	740	Dulzura, San Diego County, California	1893. Sept. 14	[e] ♂ ad.	138	52	21	.....
1414	(d)	768	....do....	Oct. 18	[e] ♂ ad.	130	48	20	.....
823	(d)	218	San Bernardino Valley, California....	Apr. 11	[f] ♀ ad.	147	48	18.0	12.0
1946	(d)	11	....do....	1891. Oct. 17	♂.	130	47	17.0	......
825	(d)	217	....do....	1893. Apr. 10	♀ ad.	138	48	19.0	......
824	(d)	10	....do....	1891. Oct. 10	♂.	135	51	19.0	......
1947	(d)	......	....do....	1894. May 18	♂ juv.	127	44.5	19.0	......
1242	(d)	......	....do....	1893. June 28	♀ juv.	130	48	19.0	......
1243	(d)	......	....do....	June 20	♀ juv.	133	45	16.9	......
1244	(d)	......	....do....	June 26	♂ juv.	104	38	16.0	......

[a] In the collection of the American Museum of Natural History, New York.
[b] Mammæ, 4 pairs (Holzner).
[c] Collected by F. X. Holzner.
[d] Lent me by Mr. Samuel N. Rhoads; measurements by Mr. Herron.
[e] Collected by Chas. H. Marsh.
[f] Type.

Genus BAIOMYS True (1894).

Baiomys True, Proc. U. S. Nat. Mus., XVI, p. 758, Feb. 4, 1894.

Ascending ramus of mandible short and erect. Condyle terminal. Coronoid process well developed, uncinate, and near the condyle. Size very small, tail short. Plantar tubercles, six. Soles (fig. 67) hairy (*True*).

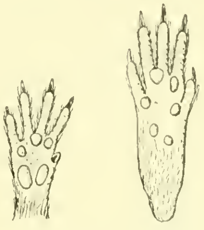

Fig. 67.—Baiomys taylori. Under surface of feet. *a*, forefoot; *b*, hindfoot.

Type.—*Hesperomys* (*Vesperimus*) *taylori* Thomas, from San Diego, Texas.

BAIOMYS TAYLORI (Thomas).

TAYLOR MOUSE.

Hesperomys (*Vesperimus*) *taylori* Thomas, Ann. and Mag. Nat. Hist., 5th ser., XIX, 1887, p. 66 (original description).

Cricetus (*Vesperimus*) *taylori*, Thomas, Proc. Zool. Soc. Lond., 1888, p. 446.

Sitomys (*Baiomys*) *taylori*, True, Proc. U. S. Nat. Mus., XVI, 1894, pp. 757, 758. Allen, Bull. Am. Mus. Nat. Hist., VI, p. 181, May 31, 1894.

Peromyscus (*Baiomys*) *taylori*, Allen, Bull. Am. Mus. Nat. Hist., VIII, pp. 65, 66.

Type-locality.—San Diego, southern Texas. (Type in the British Museum.)

Geographical range.—Tamaulipan Tropical Tract (Rockport, Brownsville, San Diego, and 15 miles south of San Antonio, Texas).

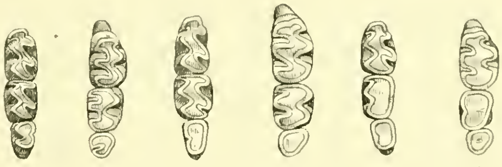

Fig. 68.—Baiomys taylori. Crowns of molar teeth, showing progressive stages of wear. *a*, *c* and *e* lower, *b*, *d*, and *f*, upper series.

Description.—One of the smallest known North American mice. In no wise closely related to any other described species from the United States, but closely related to *Sitomys musculus* Merriam (= *Baiomys musculus*), from near Colima City, Mexico.[a] Length of head and body, 53 mm.; tail vertebræ, 32; hind foot, without claw, 13; ear above crown, 5. Skull, 18 by 10. Coloration somewhat similar to that of *Mus musculus*, but without the salmon tint beneath. The upper surface is brownish gray and the under parts grayish white. The tail is scantily haired, and not distinctly bicolor.

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[a] Described in Proceedings of the Biological Society of Washington, VIII, pp. 170, 171, September 29, 1892.

Cranial and dental characters.—In addition to the generic characters pointed out by Dr. F. W. True,[a] the dentition is also peculiar. The molar tubercles are paired, though not always exactly opposite. As they are ground down with wear, the enamel pattern of the grinding surfaces assumes almost a lozenge shape (fig. 68). The skull also has an unusual shape, which is shown in fig. 69.

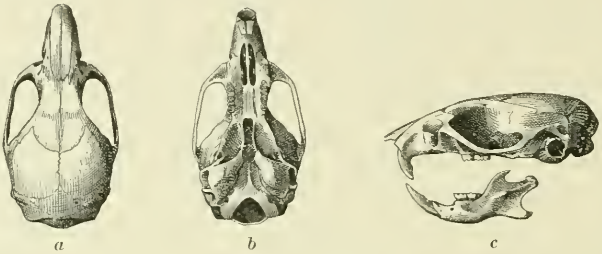

FIG. 69.—BAIOMYS TAYLORI. SKULL. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

Genus PEROMYSCUS Gloger (1841).

Peromyscus GLOGER, Hand- u. Hilfsbuch d. Naturgesch., I, 1841, pp. xxx, 95.

Type.—*Peromyscus arboreus* Gloger (=*Mus sylvaticus noveboracensis* Fischer).

Characters.—Form slender; tail not shorter than body without head; ears large; claws weak; hind legs and feet long, the latter with six conical tubercles; soles naked or less than half hairy; skull with upper margin of orbit sharp, but without a bead; mandible with coronoid process short; dental tubercles low.

SYNOPTICAL KEY TO THE SPECIES AND SUBSPECIES OF PEROMYSCUS FOUND ON THE MEXICAN BOUNDARY LINE.

a. Tail longer than head and body.
  b. Two front upper molars without subsidiary cusps or corresponding enamel loops; soles of feet naked to the heel; tail nearly naked at base, without a distinct brush at the tip.
    c. Length more than 220 mm .... *Peromyscus californicus insignis* (p. 429).
    cc. Length less than 220 mm.
      d. Under surface grayish white, stained with clay-color—never pure white. *Peromyscus eremicus fraterculus* (p. 435).
      dd. Under surface (usually) pure white, or (rarely) beautifully tinted with salmon-color (with or without a colored pectoral spot).

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[a] Proc. U. S. Nat. Mus., XVI, 1894, p. 758.

e. Length more than 210 mm.; hind foot more than 22 mm.; skull more than 26 mm. in total length; zygomatic arches almost parallel to cranial axis; chest and wrists colored ....*Peromyscus merriami* (p. 443).

ee. Length less than 210 mm.; hind foot less than 20 mm.; skull less than 26 mm.; zygomatic arches anteriorly convergent; chest without a colored spot (except occasionally—especially in *P. e. anthonyi*), and wrists all white.

f. Coloration pallid; grayish—or ochraceous—buff; upper profile of skull straight and strongly declined anteriorly..*Peromyscus stephensi* (p. 427).

ff. Coloration darker; grayish drab, tinged with cinnamon- or tawny-ochraceous; upper profile of skull more arched.

g. Size small; hind foot less than 20 mm.; coloration dark; tail quite hairy.
Peromyscus tiburonensis (p. 444).

gg. Size larger; hind foot more than 20 mm.; length, 190; tail vertebræ, 100; ear from crown, 16; hind foot, 21..*Peromyscus eremicus* (p. 431).

h. Coloration darker than *P. eremicus;* size larger; skull with zygomatic arches moderately convergent..*Peromyscus eremicus anthonyi* (p. 438).

hh. Coloration paler than *P. eremicus;* size medium; skull with zygomatic arches strongly convergent...*Peromyscus eremicus arenarius* (p. 441).

bb. Two front upper molars with distinct subsidiary cusps and corresponding enamel loops; soles of feet usually hairy from the heel to the tubercles; tail hairy throughout, with a distinct brush at the tip.

i. Nasal bones ending in a point flush with, or behind, the nasal branches of the premaxillary bones.

j. Coloration dark; upper surface broccoli brown, skull elevated, with interpterygoid fossa long and narrow........................*Peromyscus boylii* (p. 413).

jj. Coloration pale; upper surface pale grayish drab, sometimes buffy, skull flattened, with interpterygoid fossa short and narrow.
Peromyscus boylii pinalis (p. 416).

ii. Nasal bones truncated posteriorly, and ending in front of the hinder extremity of the nasal premaxillaries; soles of feet naked

k. Color above, tawny brown, much mixed with black along the median dorsal area.
Peromyscus boylii attwateri (p. 423).

kk. Color above, drab-gray, without a distinctly darker median dorsal area
Peromyscus boylii penicillatus (p. 422).

aa. Tail shorter than head and body.

m. Ear from crown more than 19 mm..............*Peromyscus martirensis* (p. 425).

mm. Ear from crown less than 18 mm.

n. Soles of feet densely hairy, with the metatarsal tubercles small, pelage dense and mole-like, resembling that of *Onychomys;* with a lanuginous tuft of hair at anterior base of ear; tail thick, with a narrow dorsal stripe; coronoid process of mandible elongated and uncinate.

o. Coloration pallid.

p. Color grayish drab. Skull lightly built Length, 160 mm.; tail vertebræ, 68; ear from crown, 14.5; length of hind foot and claw, 21.5.
Peromyscus sonoriensis blandus (p. 389).

pp. Color ochraceous drab. Skull strongly built. Length 170 mm.; tail vertebræ, 75; ear from crown, 15; length of hind foot and claw, 22.
Peromyscus sonoriensis deserticola (p. 394).

q. Length less than 140 mm.; vertebral area distinctly darker.
Peromyscus michiganensis pallescens (p. 401).

qq. Length more than 150 mm.; vertebral area not distinctly darker.

oo. Coloration dark.

r. Color rufescent.....................*Peromyscus sonoriensis rufinus* (p. 391).

rr. Color not decidedly rufescent.

s. Tail very hairy; color above reddish brown, coarsely mixed with drab and black; size large .... *Peromyscus sonoriensis clementis* (p. 400).

ss. Tail moderately hairy; color above, yellowish brown, finely mixed with drab and black; size smaller.

t. Color dusky yellowish drab; tail vertebræ, 70 mm. *Peromyscus sonoriensis* (p. 384).

tt. Color wood brown, finely mixed with black; tail vertebræ 80 mm. *Peromyscus sonoriensis medius* (p. 398).

nn. Soles of feet moderately hairy, with the metatarsal tubercles of normal size; pelage normal, not like that of *Onychomys;* tail slender, with a broad dorsal stripe.

u. Pelage short; tail almost as long as head and body, nearly naked, and not sharply bicolor .... *Peromyscus mearnsii* (p. 403).

uu. Pelage longer; tail much shorter than head and body, hairy and sharply bicolor.

v. Similar in proportions to *Peromyscus leucopus;* skull narrow, slender and lightly built, measuring less than 27 mm. in length. *Peromyscus texanus* (p. 404).

vv. Much stouter than *Peromyscus leucopus;* skull stoutly built, measuring more than 27 mm. in length.

w. Coloration pallid; skull squarish; intermediate subsidiary cusp of m^1 obsolete .... *Peromyscus tornillo* (p. 408).

ww. Coloration darker; skull with malar arches bowed outward; intermediate subsidiary cusp of m^1 present ..... *Peromyscus arizonæ* (p. 410).

Subgenus TRINODONTOMYS Rhoads (1894).

PLAINS MICE.

Trinodontomys RHOADS, Proc. Acad. Nat. Sci. Philadelphia, 1894, pp. 256, 257.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 76, footnote (Syst. Results Study N. Am. Mam. to close of 1900).

Type.—*Sitomys insolatus* Rhoads (=*Peromyscus sonoriensis deserticola* Mearns) from Oro Grande, Mohave Desert, Kern County, southern California.

Characters.—Pelage very full and soft; tail thick, hairy, sharply bicolor, with a narrow dark stripe on its upper side; hind feet with the two posterior tubercles small, the soles densely furred to the tubercles, cheek pockets not developed as food pouches; lower jaw with condyloid process shortened, with a deep notch between condyloid and angular processes, and coronoid lengthened and slightly hooked; premaxillaries narrow and laterally compressed; teeth relatively broader than in the subgenus *Peromyscus,* with the tooth-rows more divergent anteriorly.

PEROMYSCUS SONORIENSIS (Le Conte).

SONORA PLAINS MOUSE.

Hesperomys sonoriensis LE CONTE, Proc. Acad. Nat. Sci. Phila., VI, No. XI, Oct., 1853, p. 413 (Santa Cruz, Sonora Mexico, original description).—BAIRD, Mam. N. Am., 1857, p. 474 (in part); Rep. Mex. Bound. Surv., II, Pt. 2, Mam., 1859, p. 43 (in part).

Hesperomys (*Vesperimus*) *leucopus sonoriensis,* COUES, Proc. Acad. Nat. Sci. Phila. 1874, p. 179 (in small part); Monogr. N. Am. Rodentia, 1877, p. 79 (Sonoran references only).

- *Peromyscus leucopus sonoriensis*, ALLEN, Bull. Am. Mus. Nat. Hist., VII, p. 229, June 29, 1895 (in small part).

[*Peromyscus texanus*] *sonoriensis*, MEARNS, Proc. U. S. Nat. Mus., XVIII, 1896, p. 446.

[*Peromyscus americanus*] *sonoriensis*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 125 (Synop. Mam. N. Am.).

Peromyscus texanus sonoriensis, MILLER and REHN, Proc. Bost. Soc. Nat. His., XXX, No. 1, Dec. 27, 1901, p. 86 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus*] *leucopus sonoriensis*, ELLIOT, Field Col. Mus., Zool. Ser., IV, 1904, p. 181 (Mam. Mid. Am.).

Type-locality.—Santa Cruz, an old Mexican town, on the Santa Cruz River, in Sonora, about 6 miles south of Monument No. 111, Mexican Boundary Line. (Type, skin and broken skull, Cat. No. $\frac{146}{1128}$, U. S. National Museum.)

Geographical range.—Sonoran Zone of the Elevated Central Tract. Along the waters of the Gila River and its tributaries. Le Conte, in his original description of this race, states[a] that it was "collected by the Boundary Commission, under Major Graham;" and Professor Baird tells us[b] it was "characterized as *H. sonoriensis* by Major LeConte from specimen 146 of the Smithsonian collection." The skin and skull of this specimen, labeled "*Hesperomys sonoriensis*" in what is supposed to be Le Conte's handwriting, which is undoubtedly the type of *Hesperomys sonoriensis* Le Conte, and has always been so considered, are now before me. I have compared this type with topotypes which I collected at the town of Santa Cruz and at other places on the Santa Cruz River in Arizona and Sonora, and find them to be the same—the animal described below.

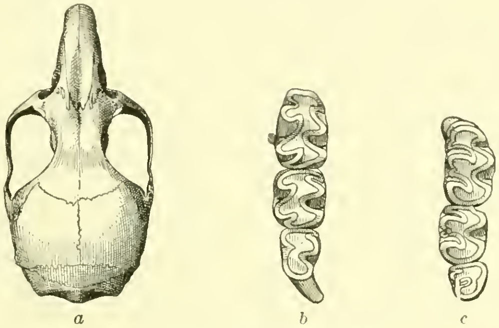

FIG. 70. PEROMYSCUS SONORIENSIS. *a*, DORSAL VIEW OF SKULL; *b*, CROWNS OF LOWER MOLARS; *c*, CROWNS OF UPPER MOLARS.

Description.—Selecting from an abundance of material a fine adult male, in winter pelage (No. $\frac{20785}{35890}$, U.S.N.M., coll. International Boundary Commission), collected by F. X. Holzner, at Lochiel, Arizona, on the Santa Cruz River, a few miles north of the type-locality, December 5, 1892, it is seen to be larger and darker in color, with larger ears than the *P. s. blandus* of the Eastern Desert Tract. The upper surface is wood brown, thickly lined with black. The woolly tuft at the anterior base of the ear is whitish, the dark spot on its outer surface distinct. The pelage is very long and dense, the tail well haired and sharply bicolored. An old female (No. $\frac{21171}{36138}$, U.S.N.M. coll. International Boundary Commission), taken on the San Pedro River, October 16, 1892, is in short summer pelage, except on the muzzle, where the winter coat is coming in. The under surface, ears, feet, and tail are much more scantily coated with hair than in winter, and the color of the upper surface is drab. The new hair on the muzzle is more yellowish. Some specimens in summer pelage are more yellow. An immature specimen (No. 58757, U.S.N.M., coll. International Boundary Commission), taken at the town of Santa Cruz, Sonora, October 21, 1893, is like the type. It is gray, tinged with drab, whitish below. Mammæ, P.$\frac{1}{1}$, A.$\frac{0}{0}$, I.$\frac{2}{2}=3$ pairs. (For skull and teeth see fig. 70.)

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[a] Proc. Acad. Nat. Sci., Phila., VI, 1853, p. 413.

[b] Mam. N. Am., 1857, p. 475.

Dr. J. A. Allen has already called attention to the dark coloration of specimens from San Bernardino ranch, at the head of the Yaqui River system; and our specimens from that locality are also darker than usual, with the exception of No. 21327, which is curiously albinistic. In the vicinity of Monument No. 77 of the Mexican Line, on the San Bernardino River, these mice were semi-aquatic, living amongst the aquatic vegetation beside the stream. Such individuals were usually dark, but on the adjacent high ground nearly typical examples of *P. s. sonoriensis* were trapped. While this dark form is recognizably different from true *sonoriensis*, I have preferred for the present, as in the case of the peculiar phase of *P. eremicus* from the same region, to wait until the Yaqui Basin Tract can be further explored, rather than name its peculiar forms from specimens from its terminal twigs, without being able to assign definite geographic ranges to the subspecies.

Fifteen years ago, when treating of the western short-tailed species of *Peromyscus*, then commonly styled the "*sonoriensis* group,"[a] I referred the forms *arcticus*, *nebrascensis*, *texanus*,[b] *sonoriensis*, and *deserticola*, as subspecies, to *Hesperomys leucopus* Rafinesque. I now regard this course as illogical, because their intergradation with *P. leucopus* was merely assumed to be a fact, and not proven. I am convinced that our trinomial system of nomenclature will only impede our progress, and come to be a hindrance, unless the rules upon which the system is founded be so rigidly adhered to as to make it an accurate index to our knowledge of the steps in the evolution of recent species. From this standpoint I have lately re-examined the members of what has been designated the "*sonoriensis* group," and have failed to trace any connection between them and *P. leucopus*, through intergrading forms.

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[a] Because Dr. Elliott Coues, in his monograph of the North American *Muridae*, published in 1877, had grouped around Le Conte's "*Hesperomys sonoriensis*" not only those of the forms here under consideration that were then known, but also several additional species which are totally distinct from them, treating the whole assemblage of species and geographical races under the head of "*Hesperomys leucopus sonoriensis.*"

[b] This erroneously, as it has been shown me by Mr. W. H. Osgood to be a member of the *Peromyscus leucopus* group.

On the contrary, comparison of series of specimens of *P. leucopus* from Minnesota with the form *nebrascensis* occupying the adjacent plains of Dakota, shows the two to be very distinct in both external and cranial characters. Similar comparisons of specimens from Kansas with those from Nebraska, and of series from Indian Territory with series from Oklahoma, furnish no evidence of intergradation. The series of *P. leucopus* from Minnesota to Indian Territory shows but little geographical variation; while the campestrian forms on the west show a wide range of variation. Indian Territory furnishes nearly typical examples of *P. leucopus;* but these specimens—from Fort Cobb—are much more closely related to the *P. texanus* than to *P. s. blandus* from the same region.

Remarks.—As in the case of *blandus*, this mouse prefers damp, grassy places; but it appears to be more prolific. A specimen collected at San Luis Springs (Lang's Ranch), September 3, 1893, contained 8 fetuses; another, taken at the head of Babacomeri Creek, Arizona, October 19, 1893, contained 6; two from the Santa Cruz River at Monument No. 111 (topotypes), October 19, 1893, contained 6 and 7; another from the same locality, October 23, 1893, contained 7.

Record and measurements of 56 Specimens of Peromyscus sonoriensis.

Museum number.		Collector's number.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hindfoot and claw.	Ear from crown.
Skin.	Skull.								
				1892		*mm.*	*mm.*	*mm.*	*mm.*
21241	37240	2067	San Bernardino Ranch at Monument No. 77.	Aug. 21	♀.	153	65	20.0	......
21237	37239	2076	.....do	Aug. 27	♂ juv.	160	65	21.0	14
22243	Alcoholic.	2081	.....do	Aug. 31	♂ im.	165	....	22.0	14.5
22255	....do....	2082	.....do	Oct. 6	♂ im.	......	....	......	......
21171	36138	2134	San Pedro River, Monument No. 98.	Oct. 16	♀ ad.	176	80	21.0	14.0
21169	36136	2138	.....do	Oct. 21	♂ ad.	165	69	22.0	15.0
21240	36158	2162	.....do	Oct. 26	♂ juv.	144	62	19.5	13.0
20603	35763	762	.....do	Nov. 2	♂ ad.	172	80	21.5	16.5
20608	35768	763	.....do	....do...	♂ im.	147	71	19.5	15.0
20602	35762	769	La Noria, near Monument No. 111, on Santa Cruz River (camp just south of Mexico line).	Nov. 8	♀ ad.	171	70	20.0	14.0
20604	35764	770	.....do	....do...	♂.	162	72	20.5	15.5
20599	35759	772	.....do	....do...	♂ ad.	157	67	21.0	15.0
20598	35758	773	.....do	....do...	♀ im.	144	61	19.5	14.5
20600	35760	774	.....do	....do...	♀ im.	153	66	21.0	15.5
20605	35765	775	.....do	....do...	♂ im.	137	60	20.5	14.0

Record and measurements of 56 Specimens of Peromyscus sonoriensis—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1892.		*mm.*	*mm.*	*mm.*	*mm.*
20625	35931	789	La Noria, near Monument No. 111, on Santa Cruz River (camp just south of Mexico line).	Nov. 11	♂ ad.	159	70	20.0	15.5
20626	37078	790	....do	....do...	♀ im.	135	59	......	......
20628	37077	794	....do	Nov. 12	♂ ad.	156	70	20.0	15.0
20622	35930	795	....do	....do...	♂ ad.	152	65	20.0	14.5
20620	35929	796	....do	....do...	♂ ad.	168	71	20.5	14.0
20624	35933	799	....do	Nov. 13	♀ im.	150	64	21.0	14.0
20633	35779	823	Patagonia Mountains, Sonora, Mexico, near Monument No. 114.	Nov. 18	♀ ad.	155	69	21.0	15.0
20709	35863	839	La Noria, near Monument No. 111, on Santa Cruz River.	Nov. 26	♂ im.	142	62	20.0	15.5
20705	37178	840	....do	....do...	♂ im.	136	58	20.0	14.0
20703	35860	841	....do	....do...	♂ ad.	164	73	22.0	15.5
20707	35861	842	....do	....do...	♂ im.	140	62.5	20.0	15.0
20702	35859	843	....do	....do...	♂.	146	63	21.0	17.0
20708	35862	844	....do	....do...	♀.	165	73	21.5	15.0
20700	35857	850	....do	Nov. 28	♀ ad.	139	61	20.0	16.0
20698	35855	851	....do	....do...	♀ ad.	142	60	19.0	14.0
20697	35854	852	....do	....do...	♂ im.	145	64	19.5	13.5
20699	35856	853	....do	....do...	♀ juv.	133	55	20.5	14.0
20701	35858	854	....do	....do...	♀ juv.	133	55	19.0	13.0
20710	35864	856	....do	Nov. 29	♂ ad.	162	72	21.0	15.0
20786	35888	861	....do	Dec. 3	♀ ad.	157	67	20.0	15.0
20783	35887	862	....do	....do...	♂ ad.	154	67	20.0	15.5
20784	....	863	....do	....do...	♂ juv.	138	58	......	......
20787	....	864	....do	....do...	♀ juv.	......	......	......	......
20785	35890	866	....do	Dec. 5	♂ ad.	169	76	21.5	14
				1893.					
21580	37079	914	Tanner's Cañon above the Post Garden, Huachuca Mountains, Arizona, near Monument No. 102.	Aug. 5	♂ ad.	156	65	20.5	14
21616	36792	1075	....do	Oct. 4	♂.	163	62	21.	14
21619	36795	1076	....do	....do...	♀ ad.	159	66	20.5	15
21620	36796	1077	....do	....do...	♂ juv.	......	......	......	......
21621	36797	1079	....do	Oct. 5	♀ juv.	......	......	......	......
21624	36800	1082	....do	Oct. 6	♀ juv.	......	......	......	......
21628	36804	1086	....do	Oct. 8	♂.	159	72	21.	13
58875	58875	2499	San Luis Springs, Monument No. 66.	Sept. 4	♂.	160	66	20.5	14
58877	58877	2493	....do	Sept. 3	♀ ad.	166	67	21	14.5
58876	58876	2500	....do	....do...	♀ juv.	143	63	20	13.5
58874	58874	2563	....do	Oct. 1	♂ ad.	166	70	21	13.7
58801	58801	2573	Cienega at head of Babacomeri Creek, Arizona, near Monument No. 108.	Oct. 19	♀ ad.	......	......	20	13
58788	58788	2567	East bank of Santa Cruz River, at a marshy spring near Monument No. 111.	Oct. 20	♀ ad.	174	70	21	14.5
58793	58793	2568	....do	....do...	♀ ad.	173	74	21	16
58798	58798	2569	....do	....do...	♂ ad.	161	65	21	14
58800	58800	2570	....do	....do...	♀.	160	61	19.5	14
58799	58799	2571	....do	....do...	♂.	168	71	21.	13

PEROMYSCUS SONORIENSIS BLANDUS Osgood.

CHIHUAHUA PLAINS MOUSE.

Peromyscus sonoriensis blandus OSGOOD, Proc. Biol. Soc. Washington, XVII, p. 56, Mar. 21, 1904.

Hesperomys leucopus texanus, MEARNS, Bull. Am. Mus. Nat. Hist., II, pp. 285–287, Feb. 21, 1890 (Oklahoma).

Peromyscus texanus, MEARNS, Proc. U. S. Nat. Mus., XVIII, 1896, p. 446.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 84 (Syst. Results Study N. Am. Mam. to close of 1900).

?[*Peromyscus*] *texensis*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 130 (Synop. Mam. N. Am.); IV, 1904, p. 186 (Mam. Mid. Am.).

Type-locality.—Escalon, Chihuahua, Mexico.

Geographical range.—Sonoran Zone of the Eastern Desert Tract. From the Quitman Mountains, Texas, west to the Hachita Mountains, New Mexico, and southward into Mexico; intergrading with *Peromyscus sonoriensis nebrascensis* to the northward.

Description.—An adult male (No. 21177, U.S.N.M.) taken 50 miles west of El Paso, on the Mexican Line, March 21, 1892, is in winter pelage. Size small. Length, 160 mm.; tail vertebræ, 68; ear above crown, 14.5; length of hind foot and claw, 21.5. Ears small, with a lanuginous tuft at anterior base; tail short, hairy, and sharply bicolor, but without a distinct pencil of hairs at tip. Color above ochraceous drab, grayish anteriorly, deepening laterally and posteriorly to ochraceous cinnamon, everywhere finely lined with black, most thickly in the vertebral area; feet and under surface pure white; ears seal brown with a mixture of hoary on edges and within, and long-haired in a patch occupying the anterior portion of the convex surface; tail white, with a narrow stripe of clove brown on upper side, extending from base to tip. Soles densely hairy from the heel to the tubercles. The young are gray above, white below, with a conspicuous slate-black patch on the anterior half of the convex surface of the ear. Of 22 grown specimens taken between the Rio Grande and the San Luis Mountains on the Mexican Line, March 21 to June 1, and one in September, but three were in the rufescent pelage, the rest varying from pale smoke gray to drab gray, several being more or less intermediate between the grayish and ochraceous phases of coloration, which depend to some extent upon season.

Cranial characters.—As the members of the *Peromyscus sonoriensis* group have long been considered to be specifically identical with *Peromyscus leucopus* (Rafinesque), I will compare one of the forms of *P. sonoriensis*, namely, *P. s. nebrascensis*, with that species: I am able to detect but slight differences between series of skulls of *P. leucopus* from the District of Columbia, Lexington (Kentucky), and various other eastern localities, and series of the same species from Fort Snelling and Elk River, Minnesota. Comparing series of skulls of *P. leucopus* from the forested areas of southern and western Minnesota (Fort Snelling and Elk River) with nine skulls of *P. sonoriensis nebrascensis* from the adjacent plains of South Dakota, the following differences are found: The skull of *P. s. nebrascensis* is smaller; its zygomatic arches are more nearly parallel to the cranial axis; rostrum relatively shorter, with broader nasals; incisive foramina longer, and the mandible shorter, with a remarkable reduction in the length of its condyloid process, while its coronoid is more developed. Comparing the skulls of the several forms of *Peromyscus sonoriensis* from the Boundary strip together, the Texas specimens are seen to be considerably the smallest; *P. s. sonoriensis* is larger; *P. s. deserticola* and *P. s. clementis* are decidedly the largest, *deserticola* being broader and more massive than *clementis;* and *medius*, while smaller than *clementis*, agrees with it in being narrower and less massive than *deserticola*. In *rufinus* the coronoid is most decidedly elongate and uncinate.

Remarks.—Seven adults of this species, taken in Oklahoma in October and November, are all in the "red" coat, and are much more ochraceous than typical *P. s. blandus*. They somewhat resemble *P. aureolus*, as Baird has previously remarked in speaking of certain specimens which he identified as *P. texanus*. This Oklahoma series, collected by Mr. Jenness Richardson, has been recently sent to me for reexamination by Dr. J. A. Allen from the collection of the American Museum of Natural History, New York. It constitutes a local phase of this species, somewhat intermediate between true *P. s. blandus* and *P. s. nebrascensis*, but differing in coloration from either. *Peromyscus s. blandus* has a decided leaning toward the genus *Onychomys*. Its coloration and the texture of the furry coat are very suggestive of *Onychomys*. Added to this, it has the coronoid process of the mandible hooked and longer than usual; the posterior pair of tubercles on the soles of its hind feet reduced in size (in *Onychomys* these are wanting), and the soles densely furred to the tubercles.

Habits and local distribution.—The plains mouse of the Eastern Desert Tract prefers to reside in open country, and the wetter the better. At Dog Spring I caught them in traps set in shallow water; but at Monuments 15 and 40 I found it on rocky hills and buttes, as well as on the level plain. Grassy spots around springs are its favorite abodes, and in such places it is abundant. Like *Onychomys*, it is largely carnivorous, devouring insects or any animal food. It proved to be an annoyance by eating the small mammals caught in our traps, beginning at the abdomen and turning the skin inside out. At Monument No. 46, Mosquito Springs, females were taken May 13 and 14, 1892, each containing four large fetuses; and a half-grown young one was taken May 15.

Measurements of 23 specimens of Peromyscus sonoriensis blandus.

Museum number.		Collector's number.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1892.		*mm.*	*mm.*	*mm.*	*mm.*
21177	37204	1556	South of Wragg's ranch, Monument No 15.	Mar. 21	♂ ad.	160	68	21.5	14.5
21160	37221	1587	.....do	Mar. 26	♀ ad.	160	65	......	14.5
21248	37244	1593	.....do	Mar. 28	♂ ad.	152	61	20.5	12
21229	....	1603	.....do	Mar. 29	♂ ad.	158	64	22	13
21161	37220	1641	.....do	Apr. 5	♂ ad.	165	73	22	12.5
21232	37196	1667	Near Carrizalillo Springs, New Mexico, camp at Monument No. 33.	Apr. 17	♀ ad.	156	65	21.5	13.5
21228	37222	1673	.....do	Apr. 18	♂ im.	156	67	20.5	13
21153	37159	1675	.....do	Apr. 19	♂ ad.	151	63	20.5	13
21159	37197	1676	.....do	....do...	♀ ad.	143	62	22	13
21158	37198	1694	100 miles west of the Rio Grande, upper corner Monument No. 40.	Apr. 25	♂ im.	171	73	23	13
21178	37223	1695	.....do	....do...	♂ ad.	164	70	21	14
21231	....	1706	.....do	Apr. 27	♂ ad.	163	68	22.5	14
21230	37226	1715	.....do	Apr. 30	♂ im.	149	63	20.5	12.5
21156	37228	1719	.....do	May 1	♀ ad	158	70	22	13
21233	37203	1794	Mesquite Springs, Chihuahua, near Monument No. 46.	May 11	♂	165	74	21.5	13.5
21154	37234	1796	.....do	May 12	♀ im.	165	74	20	14.5
21157	37236	1797	.....do	....do...	♂ im.	165	73	20	14
21176	37233	1798	.....do	May 13	♀ ad.	160	69	20.5	14.5
21175	37195	1802	.....do	May 14	♀ ad.	165	73	21	15.5
21328	37235	1805	.....do	May 15	♂ im.	119	57	......	10
21155	37023	1822	Dog Springs, Grant County, New Mexico, near Monument No. 55.	May 31	♀ ad.	......	....	20.5	14
21247	37193	1825	.....do	June 1	♂ ad.	164	72	21	15
				1893.					
58881	....	2525	.....do	Sept. 17	♂ ad.	152	64	21	13.7

PEROMYSCUS SONORIENSIS RUFINUS (Merriam).

ARIZONA WOOD MOUSE.

Hesperomys leucopus rufinus Merriam, North American Fauna, No. 3, Sept. 11, 1890, pp. 64–66 (original description).

Hesperomys leucopus sonoriensis, Mearns, Bull. Am. Mus. Nat. Hist., II, Art. XX, Feb. 21, 1890, pp. 284–287 (San Francisco and Mogollon mountains, Arizona).

? *Sitomys sonoriensis*, Allen, Bull. Am. Mus. Nat. Hist., V, Art. VI, April 28, 1893, pp. 74, 75.

Peromyscus leucopus rufinus, Allen, Bull. Am. Mus. Nat. Hist., VII, Art. VI, June 29, 1895, pp. 232–234.

Peromyscus rufinus, Allen, Bull. Am. Mus. Nat. Hist., VIII, p. 252, Nov. 25, 1896.—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 82 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus*] *rufinus*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 126 (Synop. Mam. N. Am.).

Pow-wip'-seha of the Hopi Indians.

Type-locality.—Altitude of 9,000 feet on San Francisco Mountain, Arizona. (Type, skin and skull, Cat. No. $\frac{17646}{24582}$, U. S. National Museum.)

Geographical range.—Transition and Boreal zones of the mountains of the Elevated Central Tract.

When, in 1889, at the suggestion of Dr. J. A. Allen, I undertook the rearrangement of the American Museum specimens of the short-tailed wood mice and plains mice of the West, which were then known collectively as *Hesperomys leucopus sonoriensis*, I restricted the application of Le Conte's name *sonoriensis* to that one of the five forms represented in the specimens examined which came from the place geographically nearest to the type-locality of *sonoriensis*, viz., to the species inhabiting the mountains of central Arizona, the type locality of Le Conte's *Hesperomys sonoriensis* being the Mexican town of Santa Cruz, just south of the Arizona border, in Sonora. Immediately following this, Dr. C. Hart Merriam[a] redescribed the mouse to which I had restricted the name *sonoriensis* and named it *Hesperomys leucopus rufinus*, although at the time quite as ignorant as myself concerning the identity of Le Conte's *Hesperomys sonoriensis;* and, indeed, it was not until the year 1893, when I visited Santa Cruz, Sonora (the type-locality), and collected a series of topotypes of *sonoriensis*, and afterwards compared them with the type-specimen (skin and skull of a young individual) in the U. S. National Museum, that anyone knew the characters of Le Conte's animal, and that it was a geographic (zonal) race distinct from the Arizona wood mouse (*Peromyscus sonoriensis rufinus*), to which Doctor Merriam was fortunate enough to have pinned a name that sticks. On account of its supposed resemblance to the eastern wood mouse, *Peromyscus leucopus* (Rafinesque), Doctor Merriam named it as a subspecies of that mouse without showing that it intergrades or has any connection of range with that species. In the absence of proof it is unsafe to assume either of these to be a fact, and at present the pronounced cranial and external characters of *Peromyscus sonoriensis* seem to warrant its separation as a distinct species, as it is not known to intergrade with any other.

Description.—Similar in color to *Peromyscus leucopus* (Rafinesque), but slightly smaller, with much larger and broader ears, shorter tail, and lanuginous tufts at anterior base of ears. In winter the color above is brownish fulvous, mixed with black in the median line; ears dusky with hoary edging; tail sharply bicolor, with the stripe along its upper surface narrow and dusky; feet and under parts white. In summer the color of the upper surface is tawny cinnamon. Length, 160 mm.; tail vertebræ, 68 (to end of pencil, 73); ear above crown, 15 (above notch, 19); length of hind foot, 20; skull, 26 by 14.

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[a] North American Fauna, No. 3, 1890, p. 64.

Cranial and dental characters.—The skull (fig. 71) of *Peromyscus sonoriensis rufinus* differs from that of *P. leucopus* in having the zygomatic arches elbowed out in front in such a manner that the skull is wider anteriorly than posteriorly, the reverse being true, as a rule, of *P. leucopus*. The upper profile of the skull is less flat than that of *P. leucopus*, being highest interorbitally, thence sloping sharply downward in front and behind. There are somewhat prominent supraorbital and temporal ridges which *P. leucopus* lacks, and the premaxillaries are narrower. The incisive foramen is longer than in *P. leucopus*, the interpterygoid fossa longer and narrower, and the mandible has more produced angular and coronoid processes, as in other members of the *sonoriensis* group. The teeth are shown in fig. 72.

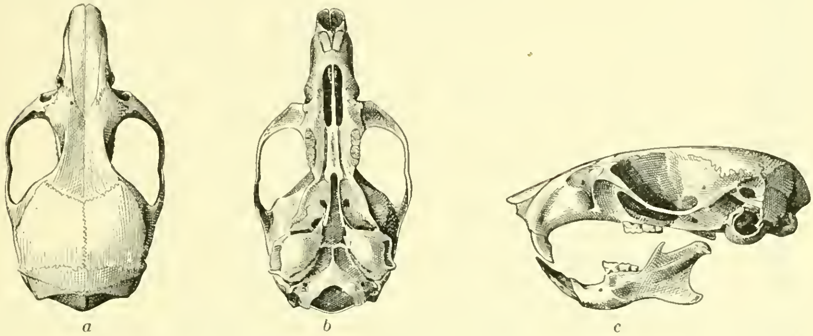

FIG. 71.—PEROMYSCUS SONORIENSIS RUFINUS. SKULL. *a*, DORSAL VIEW, *b* VENTRAL VIEW; *c*, LATERAL VIEW.

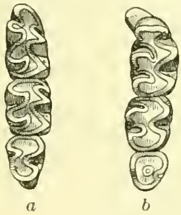

FIG. 72.—PEROMYSCUS SONORIENSIS RUFINUS. CROWNS OF MOLAR TEETH *a* LOWER SERIES, *b*, UPPER SERIES.

Habits and local distribution.—This beautiful mouse, which appears to intergrade with the plains mice of the Austral life zone, is actually a forest animal, living in great numbers in the pine, aspen, and Douglas spruce woods of the Arizona mountains. I found it in the Mogollon and San Francisco mountains, frequenting camps, cabins, and every part of the woods. On September 5, 1886, I visited the ranch of Mr. Charles Ryall, in the Verde Mountains west of Little Squaw Peak. Dozens of these mice were running about the walls, rafters, and thatching of the log cabin. A pair of slender snakes of the kind called "blue racers" were gliding gracefully about the ceiling in the thatch and through crevices between the logs. One of the snakes caught a mouse, and the pursuit had caused the excitement among its companions. On the Mogollon Mountains, August 21, 1887, I trapped a pretty wood mouse in a "delusion" mouse trap. Wishing to carry the little beast to Fort Verde, I wrapped the trap in a woolen "fascinator." Upon the road the woolly garment was nibbled and pulled into the trap, where it was cleverly made into a nice warm nest.

Measurements of 6 specimens of Peromyscus sonoriensis rufinus.

Museum number.		Collector's number.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hindfoot and claw.	Ear from crown.
Skin.	Skull.								
				1887.		*mm.*	*mm.*	*mm.*	*mm.*
[a]2353	1811	581	San Francisco Mountain, Arizona	June 6	♂ ad	158	67	18.5	14
[a]2354	1812	582	... do	June 7	♀ ad	163	70	19	15
[a]2355	1810	585	... do	June 9	♂ ad.	146	60	19	14
[a]12183	(?)	610	Baker's Butte, Mogollon Mountains, Arizona	July 19	♂ ad.	157	66	19	16
[a]2357	1814	629	.... do..	Aug. 15	♀ ad.	162	62	21	17
[a]2359	1813	632	....do..	Aug. 21	♂ im.	146	55	18	17

[a] In American Museum of Natural History, New York.

PEROMYSCUS SONORIENSIS DESERTICOLA (Mearns).

WESTERN DESERT PLAINS MOUSE.

Hesperomys leucopus deserticolus MEARNS, Bull. Am. Mus. Nat. Hist., II, Art. XX, Feb. 21, 1890, pp. 285-287 (original description).

Sitomys insolatus RHOADS, Proc. Acad. Nat Sci. Phila., 1894, pp. 256-257 (type from Oro Grande, Mohave Desert, Kern County, southern California).

P[eromyscus] t[exanus] deserticolus, MEARNS, Proc U. S. Nat. Mus, XVIII, 1896, p. 446.

[*Peromyscus americanus*] *deserticolus*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 125 (Synop Mam. N. Am.).

Peromyscus texanus deserticola, MILLER and REHN, Proc. Bost. Soc. N. H., XXX, No. 1, Dec. 27, 1901, p 85 (Syst. Results Study N. Am. Mam to close of 1900).

[*Peromyscus texensis*] *deserticola*, ELLIOT, Field Col. Mus, Zool Ser., IV, 1904, p 18 (Mam. Mid. Am.).

Type-locality.—Mojave Desert, California. (Type, skin and skull, in the American Museum of Natural History.)

Geographical range.—Lower Sonoran Zone of the Western Desert Tract. Basins of the lower Gila and Colorado rivers and head of the Gulf of California, west of the Coast Range of California.

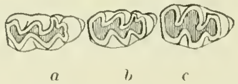

FIG. 73.—PEROMYSCUS SONORIENSIS DESERTICOLA. ANTERIOR UPPER MOLAR OF THREE INDIVIDUALS, SHOWING CHANGES IN THE FORM OF THE ENAMEL PATTERNS DUE TO WEAR.

In 1890 I described the Western Desert form of *Peromyscus sonoriensis* as a subspecies. Four years later it was redescribed by Mr. S. N. Rhoads, from a topotype, as a species—*Sitomys insolatus*—and the subgeneric name of *Trinodontomys* proposed for it, on account of "the trefoil character of the first upper molar." Mr. Rhoads has very kindly sent me the type of his *Sitomys* (*Trinodontomys*) *insolatus* for examination, and it proves to be exactly like the type of my *Hesperomys leucopus deserticolus*, which came from the same region, and with which it must, therefore, be synonymized. I can not agree with Mr. Rhoads in associating it with the subgenus *Baiomys;* and the alleged trefoil character of the first upper premolar, upon which the subgenus *Trinodontomys* was founded, is the result partly of accident, but principally of age. In the accompanying figure (fig. 73) the anterior upper molar of three individuals of different ages are outlined. In one (*a*), the type of *insolatus*, which is but slightly worn, there are two enamel folds, with the resulting trefoil pattern of the anterior enamel loop; another of Mr. Rhoads's specimens (*b*) has been worn down to a lower plane, one groove having been ground out, so that this loop appears asymmetrical; a third specimen (*c*) exhibits a section of this tooth at a still lower plane, all of the cusps having been ground away. The trefoil pattern of the crown of the first upper molar is commonly seen in youngish specimens of several species of *Peromyscus*, the pattern ever changing as the cusps and tubercles forming the crown of the tooth are gradualy worn away.

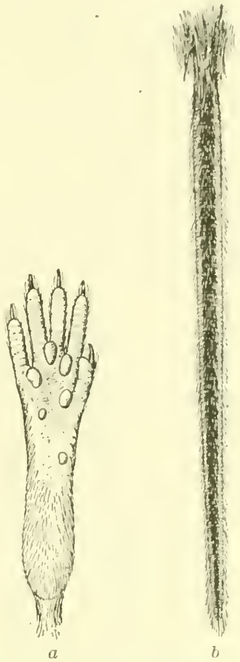

FIG. 74. PEROMYSCUS SONORIENSIS DESERTICOLA. *a*, HINDFOOT; *b*, TAIL.

Description.—This is a large, stout, long-tailed, desert race of *P. sonoriensis*, of which extreme examples are found on the deserts bordering the lower Colorado River. These specimens have massive skulls, thick tails, and stout feet (figs. 74 and 75). No. 60121, U. S. National Museum, an old female in winter pelage, taken on the lower Colorado in March, is ochraceous-cinnamon slightly mixed with black above and pure white below; ears dusky, with lanuginous tuft at base colored like the head. Summer specimens are more drab-like. The young are pale drab-gray above, gray

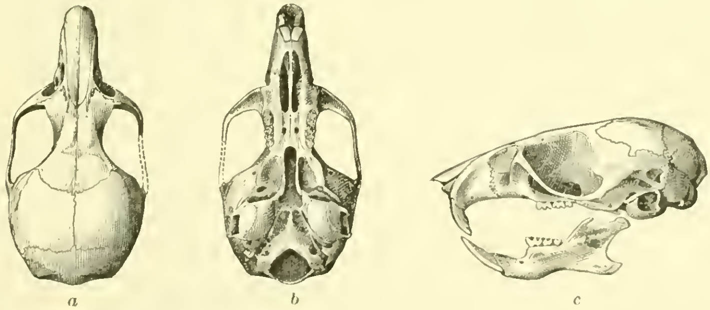

FIG. 75.—PEROMYSCUS SONORIENSIS DESERTICOLA. SKULL. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

and white below. Topotypes are smaller and grayer (less ochraceous) than the extreme Western Desert phase described above. In fact, they combine the characters of *medius* and *sonoriensis* with those of the form from the true (southern) Western Desert Tract, the type-locality having been badly selected; but the name *deserticola* can very well be made to cover the whole Western Desert Tract, as the type is nearest to the form occupying this area. From *sonoriensis* it differs in having a slightly larger foot, ear, and tail; in being more ochraceous; and in having the skull appreciably higher over the orbits. The teeth are shown in fig. 76.

Habits and local distribution.—No plains mice were met with in the dry region lying between the Santa Cruz Valley until we came to the Gila River at Adonde, Arizona, in February, 1904. It is much the commonest mammal of the lower portions of the Gila and Colorado rivers. To the rule that it is found only in damp situations there are some exceptions; but it is a species of meadows and river bottoms. Nowhere did we find it so abundant as on the vast savannas of the Colorado River about the head of the Gulf of California, where every trap set amongst the canes and hemp, or in the coarse grass, was pretty certain when next visited to contain one of these mice, which are both diurnal and nocturnal. Many cotton rats trapped at the same time were eaten by this mouse; but so neatly was the meat extracted through a small opening in the abdomen that many of the rats were made into very good skins. On the Colorado Desert mammal life became more and more scarce as we went westward, until, at last, it was hardly worth while to put out the traps. Seven pregnant females were taken from March 16 to April 16, the fetuses numbering as follows: 4, 4, 5, 4, 3, 3, and 3, the average number of young being about 4. Besides insects, quantities of *Xanthium* seeds are eaten by this mouse.

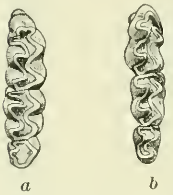

Fig. 76.—Peromyscus sonoriensis deserticola. Crowns of molar teeth. *a*, upper series; *b*, lower series.

Record and measurements of 39 specimens of Peromyscus sonoriensis deserticola.

Museum number.		Collector's number.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
59755	....	3048	Gila River, Arizona, Adonde Station, Yuma County, S. P. R. R., near Monument No. 198.	Feb. 26	♂ ad.	171	84	21.2	15.0
59758	....	3061	.....do..........................	Feb. 27	♀ ad.	185	82	23.0	17.0
60098	60098	3117	Colorado River at Monument No. 201.	Mar. 15	♀ ad.	164	77	21.0	13.0
60159	60159	3118	.....do..........................	....do...	♂ ad.	159	72	20.5	15.5
60091	60091	3143	.....do..........................	Mar. 16	♂ ad.	156	75	20.5	14.0
60097	60097	3146	.....do..........................	....do...	♀ ad.	159	72	21.0	14.0
60101	60101	3189	.....do..........................	Mar. 17	♀ ad.	168	74	21.8	13.5
60107	60107	3190	.....do..........................	....do...	♂ im.	.....	....	.....	.....
60077	60077	3191	.....do..........................	....do...	♀ ad.	168	75	21.5	15.5
60106	60106	3201	.....do..........................	Mar. 18	♂ ad.	161	72	21.0	13.5
60143	60143	3278	.....do..........................	Mar. 25	♂ ad.	172	83	21.0	15.0
60158	60158	3292	Colorado River at Monument No. 205.	Mar. 26	♂.	142	68	20.0	14.0
60165	60165	3293	.....do..........................	....do...	♂.	145	70	20.5	14.0
60144	60144	3294	.....do..........................	....do...	♂.	144	71	20.0	14.0
60114	60114	3368	Well at Cienega, 30 miles south of Monument No. 204.	Mar. 21	♂ ad.	176	80	21.0	11.8
60126	60126	3369	.....do..........................	....do...	♂ ad.	168	75	21.0	15.0
60120	60120	3370	.....do..........................	....do...	♂ ad.	176	78	22.0	14.2
60121	60121	3371	.....do..........................	....do...	♀ ad.	185	85	22.0	15.0
60117	60117	3372	.....do..........................	....do...	♀ ad.	161	73	21.0	14.3
60113	60113	3392	Colorado River opposite the mouth of Hardy River, Sonora, near Monument No. 205.	Mar. 25	♂ ad.	183	88	22.0	13.0
60130	60130	3393	.....do..........................	....	♀ ad.	194	89	22.0	15.0
60129	60129	3394	.....do..........................	....	♀ ad.	181	90	22.0	14.3
60112	60112	3395	.....do..........................	Mar. 25	♀.	165	75	21.0	14.0
60116	60116	3411	.....do..........................	Mar. 26	♂ ad.	183	81	15.0	.....
60110	60110	3412	.....do..........................	....do...	♂ ad.	168	71	14.0	.....
60111	60111	3413	.....do..........................	....do...	♀ ad.	180	80	13.7	.....
60108	60108	3414	.....do..........................	....do...	♂ juv.	157	72	.....	.....
60163	60163	3415	.....do..........................	....do...	♂ juv.	120	56	.....	.....
60128	60128	3419	.....do..........................	Mar. 27	♂ ad.	173	75	22.0	13.8
60109	60109	3420	.....do..........................	....do...	♂ ad.	.....	....	22.0	12.5
60125	60125	3421	.....do..........................	....do...	♂ ad.	162	70	21.5	12.5
60127	....	3422	.....do..........................	....do...	♂ juv.	122	58	.....	.....
60119	60119	3429	.....do..........................	Mar. 28	♀ juv.	105	46	.....	.....
60090	60090	3430	.....do..........................	....do...	♂ juv.	124	57	.....	.....
61611	Alcoholic.	3434	.....do..........................	....do...	♂ ad	.....	....	.....	.....
60168	60168	3474	Fort Yuma San Diego County, California, near Monument No. 206.	Apr 2	♂ juv.	126	57	.....	.....
60748	60748	1146	Seven Wells, Salton River, Colorado Desert, Lower California, near Monument No 213	Apr. 16	♀ ad.	178	89	23.0	14.5
60749	60749	1148	.....do..........................	....do...	♀ ad	166	83	21.0	16.0
60750	60750	1152	.....do..........................	Apr. 17	♂ ad.	168	81	22.0	15.5

PEROMYSCUS SONORIENSIS MEDIUS (Mearns).

SAN DIEGO PLAINS MOUSE.

Peromyscus texanus medius Mearns, Proc. U. S. Nat. Mus., XVIII, 1896, p. 446 (p. 4 of advance sheet issued March 25, 1896; original description).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 85 (Syst. Results Study N. Am. Mam. to close of 1900).

Sitomys americanus thurberi Allen, Bull. Am. Mus. Nat. Hist., V, Art. XII, Aug. 18, 1893, pp. 185, 186 (in part).

[*Peromyscus texensis*] *medius*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 131 (Synop. Mam. N. Am.).

[*Peromyscus*] *thurberi*, Elliot. Field Col. Mus., Zool. Ser., IV, 1904, p. 176 (part) (Mam. Mid. Am.).

Type-locality.—Nachoguero Valley, Lower California, near Monument No. 238. (Type, skin and skull, Cat. No. 61059, U. S. National Museum.)

Geographical range.—Sonoran and Transition zones of the Pacific Coast Tract. From the Coast Range to the Pacific.

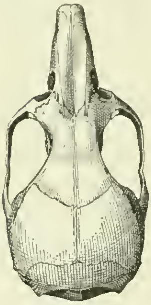

Fig. 77.—Peromyscus sonoriensis medius. Skull.

Description.—In the original description of this form it was said that "between the ranges of the subspecies *gambellii* and *thurberi*, both dark-colored races of *Peromyscus sonoriensis*, there is a narrow strip of southern and Lower California, bordering the Pacific Ocean for several hundred miles and extending east to the Coast Range of mountains, occupied by the present race, which differs from either of those above mentioned in being paler, with more drab and clay-colored tints. It is smaller than *P. s. gambellii*, with much larger ears and a shorter tail. Its paler, more ochraceous coloration at once distinguishes it from *P. s. thurberi*, with which it agrees in size. From *P. s. deserticola* of the interior deserts, it differs in being less robust and in having somewhat larger ears and much darker color." The upper surface is deep wood-brown, shading to russet on the cheeks, sides, and rump, and thickly mixed with black above, giving a distinctly dusky vertebral area; ears clove-brown, densely coated with hair, with a faint hoary edging; top of head wood-brown, paler than the back; under surface of body and feet pure white; tail, black above, white on sides and beneath. Mammæ, three pairs (P. $\frac{1}{1}$, A. $\frac{0}{0}$, I. $\frac{2}{2}$). The skull is shown in fig. 77.

Remarks.—The San Diego plains mouse frequents the seashore and the dampest parts of the mountains and plains of the Pacific Coast Tract. At Jacumba Hot Springs it was abundant, and four pregnant females were taken from May 18 to 23, 1894, the young numbering 3, 5, 6, and 6, respectively. Young were taken in traps late in May. At San Isidro, Lower California, a female contained three fetuses as late as June 29.

Record and measurements of 41 specimens of Peromyscus sonoriensis medius.

Museum number.		Collector's number.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
60759	60759	1269	Jacumba, San Diego County, California, near Monument No. 233.	May 18	♂ im.	160	72	20.5	13.0
60760	60760	1271	.....do	....do...	♀ ad.	170	80	21.0	13.5
60762	60762	1280	.....do	May 19	♂ ad.	182	86	21.0	14.5
60763	60763	1282	.....do	....do...	♀.	167	73	19.0	14.0
61054	61054	1292	.....do	May 20	♂ ad.	170	78	21.5	13.0
60766	60766	1302	.....do	May 21	♀ ad.	171	81	20.5	13.8
60769	60769	1308	.....do	May 22	♂.	160	75	21.0	13.0
60771	60771	1317	.....do	May 23	♂.	156	73	......	......
60772	60772	1319	.....do	....do...	♀ ad.	167	78	20.0	16.0
60773	60773	1321	.....do	....do...	♀ ad.	187	88	22.0	16.5
60776	60776	1354	.....do	May 28	♀ ad.	169	78	20.5	11.5
60778	60778	1377	.....do	May 30	♀ ad.	171	75	20.0	14.0
60779	60779	1379	.....do	....do...	♂.	162	75	20.0	15.5
61036	61036	3535	.....do	May 18	♂ ad.	163	74	21.0	14.0
61040	61040	3552	.....do	May 21	♀ ad.	173	78	21.0	15.0
61659	Alcoholic.	3596	.....do	May 29	♀ ad.	169	77	21.0	15.0
61059	61059	3623	Nachoguero Valley, Lower California, near Monument No. 238.	June 4	♂ ad.	160	70	21.0	17.0
60787	....	1401	.....do	....do...	♂ ad.	164	77	20.5	14.0
60789	60789	1415	.....do	June 6	♂ ad.	183	83	21.5	17.5
60793	....	1444	Campbell's Ranch, at Laguna, San Diego County, California.	June 14	♂ ad.	154	66	20.0	13.0
60796	60796	1463	.....do	June 16	♀ juv.	......	....	......	......
60797	60797	1476	.....do	June 18	♂ ad.	165	70	21.0	13.0
61321	61321	3650	.....do	June 12	♂ ad.	155	68	21.0	15.0
60804	60804	1523	San Isidro Ranch, Lower California, near Monument No. 250.	June 29	♀ ad.	170	77	20.0	13.5
61076	61076	1538	.....do	June 30	♂ juv.	160	71	20.0	13.3
61077	61077	1551	.....do	July 2	♂ ad.	160	77	21.5	16.0
61078	61078	1562	.....do	July 3	♀ ad.	163	75	21.0	14.5
61080	61080	3704	.....do	June 29	♂ ad.	182	87	21.7	14.0
61081	61081	3705	.....do	....do...	♀ ad.	169	77	21.0	13.0
61082	61082	3706	.....do	....do...	♀ ad.	165	76	20.0	14.0
......	61081	3724	.....do	June 30	♀ ad.	160	73	20.0	14.0
61085	61085	3737	.....do	July 1	♂ ad.	154	69	21.0	15.0
61086	61086	3738	.....do	....do...	♂ ad.	157	72	20.0	15.0
61088	61088	3749	.....do	July 2	♀ ad.	183	83	21.3	14.0
61089	61089	3750	.....do	....do...	♀.	153	71	19.0	13.2
61095	....	3767	Jamul Creek, near El Nido P. O., San Diego County, California	July 6	♀ ad.	176	82	20.0	14.0
60805	60805	1569	.....do	....do...	♂ ad.	169	77	21.0	13.0
61097	61097	3775	.....do	July 8	♂ ad.	176	79	21.3	13.0
60807	60807	1592	.....do	July 7	♂.	163	75	20.5	13.0
60808	60808	1591	.....do	....do...	♀.	152	76	20.5	12.2
61100	61100	3784	Pacific Ocean at the last monument (No. 258).	July 11	♂ ad.	169	78	21.0	15.0

PEROMYSCUS SONORIENSIS CLEMENTIS (Mearns).

SAN CLEMENTE MOUSE.

Peromyscus texanus clementis MEARNS, Proc. U. S. Nat. Mus., XVIII, 1896, pp. 446, 447 (p. 4 of advance sheet issued March 25, 1896; original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 84 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus texensis*] *clementis*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 130 (Synop. Mam. N. Am.); IV, 1904, p. 187 (Mam. Mid. Am.).

Type-locality.—San Clemente Island, off southern California. (Type, skin and skull, Cat. No. 61117, U. S. National Museum.)

Geographical range.—Islands of the Santa Barbara group, southern California, and the Coronados Islands, off Lower California.

This insular mouse was described as a subspecies of the mainland form for the reason that examples from the nearer islands seemed to be somewhat intermediate in character between the typical form on San Clemente Island and that of the coast. The species occurs on each of the Coronados Islands and on several islands of the Santa Barbara group.

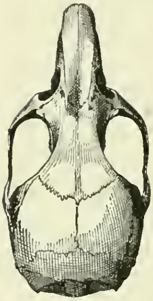

FIG. 78.—PEROMYSCUS SONORIENSIS CLEMENTIS. SKULL.

Description.—This mouse is considerably larger and much blacker than *P. s. medius* of the neighboring mainland, and has a more pronounced reddish tinge. The upper surface is drab anteriorly, strongly tinged with burnt umber posteriorly; top of head drab-gray; ears black, with faint hoary edging; feet and under surface white; tail sharply bicolored, blackish above. The above description is based on a series of specimens taken by the author in August, 1894. Mr. A. W. Anthony, the well-known naturalist of San Diego, collected a series at the same time, which he kindly placed at my disposal. The skull (fig. 78) of this island race, while almost as large as that of *P. s. deserticola* from the lower Colorado River, is more slender and fragile. Iris dark hazel.

Habits and local distribution.—This appears to be the only mouse on San Clemente Island, where it is exceedingly abundant, living on sandy shores amongst the cactus and in ravines under such shrubs as the Christmas berry, cherry, and sumach. It feeds on the ripe fruit of the prickly pear, *Opuntia* (*Platopuntia*) *lindheimeri littoralis*, which stains its pelage. About 40 specimens were taken by Mr. A. W. Anthony and myself. Similar mice were said to abound on the Coronados Islands, south of the International Boundary.

Measurements of 24 specimens of Peromyscus sonoriensis clementis.

Museum number.		Collector's number.	Locality.	Date.	Sex.	Total length.	Total vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1894.		*mm*	*mm.*	*mm.*	*mm.*
61106	61106	3806	San Clement Island, California...	Aug. 24	♂ ad.	164	74	20.8	14.5
61107	61107	3807	.....do....	....do...	♂ ad.	161	73	21.0	16.0
61108	61108	3808	.....do....	....do...	♀ ad.	163	72	21.0	15.0
61109	61109	3809	.....do....	....do...	♀ ad.	165	75	20.5	15.0
61112	61112	3814	.....do....	Aug. 26	♂ ad.	167	77	20.2	16.5
61113	61113	3815	.....do....	....do...	♀ ad.	160	68	20.0	15.0
61117	61117	3819	.....do....	Aug. 27	♂ ad.	177	77	21.0	17.0
61118	61118	3820	.....do....	....do...	♀ ad.	168	75	20.5	16.0
61119	61119	3821	.....do....	....do...	♀ ad.	166	75	20.5	15.0
61120	61120	3822	.....do....	....do...	♀ im.	156	71	20.1	14.5
61123	61123	3827	.....do....	Aug. 28	♀ ad.	172	78	21.5	15.0
13620[a]	11969	97	.....do....	Aug. 23	♀ ad.	160	72	......	......
13621[a]	11970	98	.....do....	....do...	♂ ad.	158	84	......	......
13622[a]	11971	99	.....do....	Aug. 24	♂ ad.	157	84	......	......
13623[a]	11972	100	.....do....	....do...	♂ ad.	163	87	......	......
13624[a]	11973	101	.....do....	....do...	♂ ad.	165	85	......	......
13627[a]	11976	104	.....do....	Aug. 26	♂ ad.	165	78	......	......
13628[a]	11977	105	.....do....	....do...	♀ ad.	162	80	......	......
13629[a]	11978	106	.....do....	....do...	♀ ad.	160	73	......	......
13630[a]	19979	107	.....do....	....do...	♀ juv.	148	73	......	......
13631[a]	11980	108	.....do....	....do...	♂ im.	152	70	......	......
13632[a]	11981	111	.....do....	Aug. 27	♀ im.	150	72	......	......
13633[a]	11982	112	.....do....	....	♀ ad.	161	80	......	......
13634[a]	11983	113	.....do....	....	♂ ad.	179	79	......	......

[a] In American Museum of Natural History, New York.

PEROMYSCUS MICHIGANENSIS PALLESCENS (Allen).

PALLID MOUSE.

Peromyscus texanus ALLEN, Bull. Am. Mus. Nat. Hist., VIII, 1896, p. 64 (not of Waterhouse).

Peromyscus michiganensis pallescens ALLEN, Bull. Am. Mus. Nat. Hist., VIII, Art. XIV, Nov. 21, 1896, pp. 238, 239 (original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 80 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus michiganensis*] *pallescens*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 140 (Synop. Mam. N. Am.).

Type-locality.—San Antonio, Texas. (Type, skin and skull, No. $\frac{12213}{10565}$, American Museum of Natural History.)

Geographical range.—The subspecies in its typical form is known only from the vicinity of San Antonio, Texas. Kansas specimens are intermediate between the subspecies *michiganensis* and *pallescens*.

The following is Doctor Allen's description of this subspecies, which is known only from the type series:

Adult.—Above grayish brown, with a slight yellowish wash, mostly confined to the sides, strongly varied with dull blackish brown, especially along the median line, often forming a distinct broad blackish dorsal band; below clear grayish white, the tips of the hairs being white and the basal portion plumbeous; ears blackish brown, narrowly edged with white; tail sharply bicolor, upper third of its circumference blackish brown, rest white; feet white, with a faint buffy tinge.

Young.—Dull gray brown (dark "mouse-gray") above, with a darker (blackish) median band; otherwise like the adult.

Measurements.—Male (type): Total length, 127; tail vertebræ, 52; hind foot, 16; ear (from dry skin), 11.

Nine adult males measure as follows: Total length, 126 (121–130); tail vertebræ, 51 (50–52); hind foot, 16 (15–17).

A single adult female is larger than the largest male of the series.

Type, No. $\frac{12213}{10565}$, male adult, San Antonio, Texas, February 7, 1896; H. P. Attwater.

This subspecies is based on a series of 10 adults and 7 two-thirds grown young, all winter specimens (December 14–March 19), taken mostly in January and February.

They are so different in color and size from a large series of *Peromyscus michiganensis* from Fort Snelling, Minnesota, collected by Doctor Mearns, that they would seem to be specifically distinct, were it not that a large series of winter specimens from Lawrence, Kansas, collected by Prof. L. L. Dyche, are so nearly intermediate in both size and coloration as to render it probable that *P. m. pallescens* is merely a pale, depauperate form of *P. michiganensis.*

The measurements of a series of adults from each locality compare as follows:

Locality.	Sex.	Total length.	Tail vertebræ.	Hindfoot.
		mm.	*mm.*	*mm.*
Fort Snelling	3 males	143 (144–146)	56 (55–59)	17.3 (17–18)
	5 females	149 (144–153)	57 (54–63)	18.1 (18–18.5)
Lawrence	10 males	137 (130–149)	51 (43–58)	17.9 (16–19)
	5 females	146 (137–153)	57 (55–63)	18.0 (16–19)
San Antonio	9 males	126 (121–135)	51 (50–52)	16.0 (14–17)

The Kansas specimens are thus good intergrades, and are almost distinct enough to merit recognition in nomenclature. They are rather nearer the Fort Snelling series than the San Antonio series.

In coloration *P. m. pallescens* bears a close general resemblance to *Peromyscus canus* Mearns from the same locality, but can be readily distinguished by its relatively shorter tail and hind foot and much smaller size. (Bull. Am. Mus. Nat. Hist., VIII, 1896, p. 238.)

Subgenus PEROMYSCUS.

WOOD MICE.

Onychomys and *Baiomys*, formerly subgenera of the old genus *Peromyscus*, are regarded here as distinct genera. Merriam erected the subgenus *Megadontomys* in 1898, and Osgood the subgenus *Haplomylomys* in 1904, leaving a complex assemblage of forms to represent the subgenus *Peromyscus*, which is susceptible of further subdivision. Associated with typical *leucopus* are a number of forms, including *mearnsii*, *texanus*, *tornillo*, and *arizonæ* on the Mexican

Border, which constitute a very homogeneous group. At present I am including *truei*, *boylii*, and even *stephensi* (which is near *eremicus*) in the subgenus *Peromyscus*. The characters of the feet and tail in this subgenus are indicated in fig. 79.

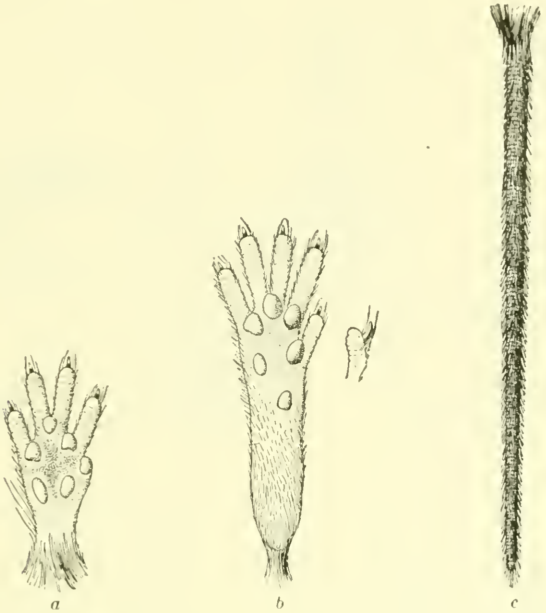

FIG. 79.—PEROMYSCUS LEUCOPUS. *a*, FOREFOOT; *b*, HINDFOOT; *c*, TAIL.

PEROMYSCUS MEARNSII (Allen).

MEARNS MOUSE.

Vesperimus mearnsii ALLEN, Bull. Am. Mus. Nat. Hist., III, No. 2, Art. XX, June 30, 1891, p. 299 (original description).

Sitomys mearnsii, BRYANT, Zoe, III, Oct., 1892, p. 214.—ALLEN, Bull. Am. Mus. Nat. Hist., VI, May, 1894, pp. 179–181.

P[eromyscus] mearnsii, ATTWATER, Bull. Amer. Mus. Nat. Hist., V, Nov. 8, 1895, p. 331.

Peromyscus mearnsi, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 132 (Synop. Mam. N. Am.).

Peromyscus mearnsii, MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 78 (Syst. Results Study N. Am. Mam. to close of 1900).

Type-locality.—Brownsville, Texas. (Type, skin and skull, in the American Museum of Natural History.)

Geographical range.—This species inhabits the Tamaulipan Tropical Tract, in southern Texas, where it has been found, along the Gulf of Mexico, in the strip of country extending from Rockport to Brownsville.

Description (based on seven topotypes).—Upper surface dusky grayish-brown, suffused with fawn color, which is strongest on the sides; under parts pure white in winter, grayish white in summer;

tail long, nearly naked in summer, not distinctly bicolor; ears large and nearly naked; feet whitish, with soles hairy to the tubercles. Length 190 mm.; tail vertebræ, 95; ear from crown, 14; length of hind foot, 21. Skull, 26 by 13.7.

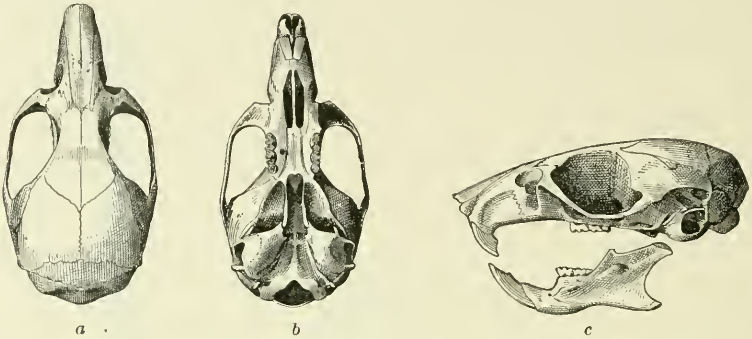

FIG. 80.—PEROMYSCUS MEARNSII. SKULL. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

The young, when quite small, are slate-gray above, and grayish white below, with a black patch occupying the anterior third of the convex surface of the ear.

Cranial and dental characters.—The skull and teeth of *Peromyscus mearnsii* (figs. 80 and 81) indicate a species allied to, but probably specifically distinct from, *P. leucopus*. The skull is smaller than that of *P. texanus*, from which it also differs in shape.

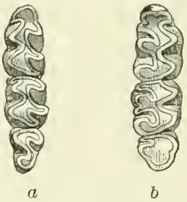

FIG 81.—PEROMYSCUS MEARNSII. CROWNS OF MOLAR TEETH. *a*, LOWER SERIES; *b*, UPPER SERIES.

Remarks.—This mouse differs from *P. texanus*, its next neighbor on the west, in being more scantily coated throughout, especially as to its tail, which is much longer than that of *P. texanus*, and differs further in not being sharply bicolor. In full winter pelage it is not so strikingly different, but the fur is shorter at all seasons.

PEROMYSCUS TEXANUS (Woodhouse).

TEXAS GRAY WOOD MOUSE.

Hesperomys texana WOODHOUSE, Proc. Acad. Nat. Sci. Phil., VI, No. VII, Feb., 1853, p. 242 (original description); Report of an Expedition down the Zuñi and Colorado Rivers, by Capt. L. Sitgreaves, 1853, pp. 48, 49, pl. II.

Arvicola (Hesperomys) texana, AUDUBON and BACHMAN, Quad. N. Am., III, 1854, p. 319.

Hesperomys texanus, BAIRD, Mam. N. Am., 1857, p. 464 (in part).

Peromyscus canus MEARNS, Proc. U. S. Nat. Mus., XVIII, 1896, p. 445 (p. 3 of advance sheet issued March 25, 1896).—ALLEN, Bull. Am. Mus. Nat. Hist., VIII, Art. V, April 22, 1896, pp. 64, 65.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 71 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus*] *canus*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 132 (Synop. Mam. N. Am.).

Type-locality.—Texas, near the Rio Grande. "I procured this little animal on the Rio Grande near El Paso." (*S. W. Woodhouse.*) (Type, skin in alcohol and fragments of skull, Cat. No. $\frac{2559}{37026}$, U. S. National Museum.)

Geographical range.—Inhabits the Sonoran Zone of the Middle Texas Tract. It has been found at San Antonio (Attwater), and from Bee County to Kinney County, along the Rio Grande.

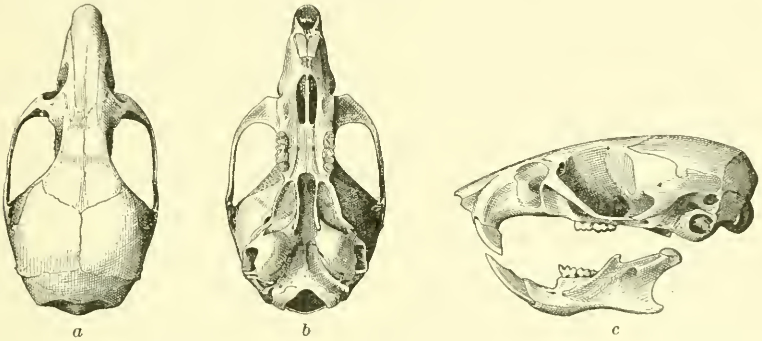

FIG. 82.—PEROMYSCUS TEXANUS. SKULL. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

Description.—Similar in proportions to *Peromyscus leucopus* (Rafinesque). Color above drab-gray, with a dark vertebral area, where the pelage is thickly lined with black. Feet and under parts pure white; tail bicolored, blackish above, white below; ears and tail well coated with hair; soles of feet densely pilose posteriorly. Mammæ, three pairs.

The young, which are born at all seasons of the year, are slate-gray, with whitish under parts, bicolored tails, and the usual black spot on the ear. The young acquire the adult pelage in precisely the same manner that *Peromyscus eremicus* does (see p. 433), it beginning on the under surface, extending to the flanks, and thence across the middle of the back, leaving the rump and nape to be covered last. Length, 175 mm.; tail vertebræ, 75; ear from crown, 12; hind foot, 21. Skull, 26.5 by 13.5. Teats, $\frac{1-2}{1-2}$.

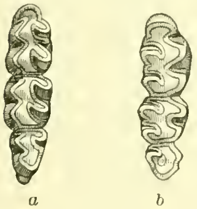

FIG. 83.—PEROMYSCUS TEXANUS. CROWNS OF MOLAR TEETH. *a*, LOWER SERIES, *b*, UPPER SERIES.

Cranial and dental characters.—The skull (fig. 82) is narrow, slender, and rectangular, with the braincase low and elongated, and the rostral portion long. The teeth (fig. 83) are much smaller than those of *P. tornillo*, with which it intergrades on the west.

Remarks.—This mouse, though similar in appearance to *Peromyscus mearnsii* (Allen), may be readily distinguished from that species by its smaller, more hairy ears and its much shorter, more hairy, and sharply bicolored tail, as well as by its longer fur at all seasons. The skull of *P. mearnsii* is smaller, and has a more swollen brain-case, shorter and more depressed rostrum, and shorter pterygoid fossa and interpterygoid notch. The dentition also is perhaps a little heavier. Compared with *P. leucopus*, the skull is lower and more slender, with a corresponding shortening of the brain-case, pterygoid fossa, and rostrum. In the vicinity of San Antonio, Texas, *Peromyscus texanus* and *P. michiganensis pallescens* occur together.

Doctor Woodhouse states, in both his preliminary and final descriptions of this mouse, that his type came from western Texas, on the Rio Grande, near El Paso. I have examined the alcoholic type (No. $\frac{2559}{37026}$ U.S.N.M.) and another specimen (No. $\frac{4748}{37155}$ U.S.N.M.), labeled in Professor Baird's handwriting "*Hesperomys texana.* W. Texas. Dr. Woodhouse." These two specimens belong to one species, the same described above. Both contained skulls, which were removed for examination, and are now preserved separately. When describing *Peromyscus tornillo,* I compared it with the types of *Hesperomys texana* Woodhouse, but the skulls were comminuted and the skins practically undeterminable from long immersion in spirits. Finding them to be different from *tornillo,* and being misled by the small size of the teeth and imperfectly cleaned rostrum of the type of *texanus,* I mistook the latter for the mouse which Mr. Wilfred H. Osgood has named *Peromyscus sonoriensis blandus.* Mr. Osgood has since carefully cleaned the rostral fragments of the type skull of *texanus,* and discovered that it is a member of the *leucopus* group, but very different from *tornillo,* the only member of that group known from the region near El Paso. As the teeth, mandible, and rostrum are exactly like those of the form which I had named *canus,* from Fort Clark, Kinney County, Texas, it is quite certain that the type of *texanus* was obtained in the Middle Texan Tract, which was crossed by Doctor Woodhouse, and that it is identical with *canus.*

Habits and local distribution.—The Texas gray mouse is an inhabitant of woodland near streams, and is abundant in such places throughout the Middle Texas Tract. The number of young, determined by dissection, in one specimen (January 12), was five.

Record and measurements of 49 specimens Peromyscus texanus.

Museum number.		Collector's number.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1892.		*mm.*	*mm.*	*mm.*	*mm.*
21134	37097	2174	Fort Clark, Kinney County, Texas	Dec. 29	♂ ad.	168	71	21.0	14.0
[a]12640	10942	2175	do	do	♀ juv.	163	70	20.5	13.5
21142	37098	2180	do	Dec. 31	♂ ad.	195	85	22.0	12.5
				1893.					
[a]12664	10965	2185	do	Jan. 3	♀ juv.	158	69	21.8	11.7
21148	37099	2186	do	Jan. 6	♂ ad.	189	91	22.8	13.5
[a]12657	10958	2187	do	do	♀ ad.	180	82	20.5	12.0
21106	37100	2194	do	Jan. 12	♀ ad.	178	78	21.5	12.5
[a]12663	10964	2195	do	do	♀ ad.	169	71	20.0	13.5
21099	37101	2196	do	do	♂ ad.	146	62	20.2	13.5
[a]12672	10973	2197	do	do	♂ ad.	167	70	20.0	12.5
21103	37104	2206	do	Jan. 13	♂ ad.	160	68	21.0	13.0
[a]12658	10959	2207	do	do	♂ ad.	173	79	22.0	13.0
21109	37096	2208	do	do	♀ ad.	175	75	21.0	11.5
[a]12656	10957	2209	do	do	♀ ad.	172	74	21.0	13.0
21145	37246	2213	do	Jan. 14	♀ ad.	176	81	22.0	13.5
[a]12647	10948	2214	do	do	♀ ad.	181	77	20.6	12.8
21136	37105	2217	do	Jan. 15	♂ ad.	174	75	20.5	12.5
[a]12643	10944	2218	do	do	♂ ad.	178	78	22.5	13.2
21144	37107	2221	do	do	♂	155	65	21.0	12.0
[a]12649	10950	2233	do	Jan. 17	♀ ad.	175	78	20.0	12.0
21137	37108	2234	do	do	♀ ad.	175	75	21.5	12.7
[a]12645	10946	2235	do	Jan. 18	♂ ad.	150	62	20.0	12.0
21138	27250	2236	do	do	♂ ad.	162	69	21.0	11.0
[a]12675	....	2248	do	Jan. 30	♂ ad.	178	79	21.5	13.0
	37188	2249	do	do	♂ ad.	......	....	......	....
[a]12674	....	2250	do	Jan. 31	♀ im.	158	68	20.5	12.7
....	....	2253	do	Feb. 1	♂ ad.	164	70	23.0	14.0
[a]12669	10970	2254	do	do	♀ ad.	162	69	21.2	14.0
....	....	2255	do	do	♀ im.	154	68	21.5	13.5
[a]12650	10951	2263	do	Feb. 3	♀ juv.	......	....	......	....
83293	83293	2264	do	Feb. 4	♀ ad.	180	80	22.0	14.5
[a]12651	10952	2265	do	do	♂ ad.	158	69	21.0	12.0
....	....	2266	do	do	♂ ad.	156	65	21.0	13.0
[a]12653	10954	2270	do	Feb. 5	♂ ad.	177	78	21.7	13.5
[a]12670	10971	2271	do	do	♂ ad.	168	73	21.3	13.1
[a]12654	10955	2272	do	do	♀ ad.	175	78	21.0	13.6
83294	83294	2276	do	Feb. 7	♂ ad.	166	68	21.0	14.0
[a]12655	10956	2277	do	do	♂ ad.	161	68	21.0	14.0
83292	83292	2278	do	do	♀ ad.	156	68	20.3	13.7
[a]12644	10945	2279	do	do	♀ ad.	169	75	22.0	13.0
83295	83295	2281	do	do	♀ ad.	175	75	21.0	15.0
[a]12661	10962	2282	do	Feb. 9	♂ ad.	159	66	21.0	14.0
....	....	2283	do	do	♂ ad.	150	62	20.5	11.5
[a]12668	10969	2284	do	do	♂ ad.	166	73	21.7	13.0
83296	83296	2285	do	do	♂ ad.	163	68	21.5	13.5
[a]12648	10949	2286	do	do	♂ ad.	160	70	22.0	12.0
83297	83297	2287	do	Feb. 10	♂ im.	154	65	22.0	14.0
[a]12671	10972	2289	do	Feb. 11	♀ ad.	182	79	20.5	13.0
....	....	2290	do	do	♀ im.	153	66	21.0	13.0

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[a] In American Museum of Natural History, New York.

PEROMYSCUS TORNILLO Mearns.

TORNILLO MOUSE.

Peromyscus tornillo Mearns, Proc. U. S. Nat. Mus., XVIII, 1896, pp. 445, 446 (p. 3 of advance sheets issued Mar. 25, 1896; original description).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 87 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus*] *tornillo*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 126 (Synop. Mam. N. Am.); IV, 1904, p. 188 (Mam. Mid. Am.).

Type-locality.—Rio Grande bottom lands, 6 miles above El Paso, Texas. (Type, skin and skull, Cat. No. $\frac{20025}{35420}$, U. S. National Museum.)

Geographical range.—An inhabitant of the Eastern Desert Tract. Known only from the bottom lands of the upper Rio Grande, living in forests of "tornillo" or screw bean (*Prosopis odorata*). There are specimens in our collection from Texas, New Mexico, and Chihuahua.

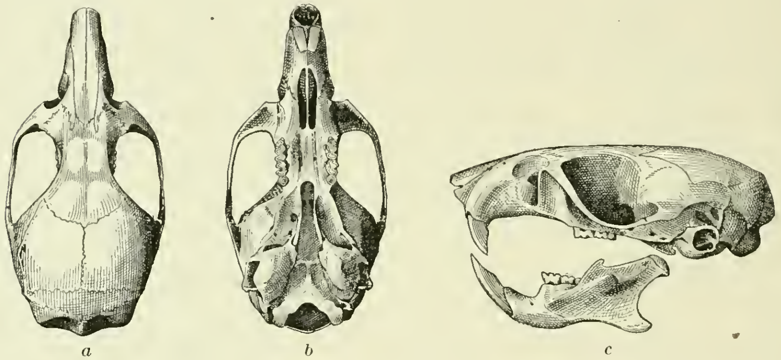

Fig. 84. Peromyscus tornillo. Skull. *a* dorsal view; *b*, ventral view; *c*, lateral view.

Description.—A large, stout species; ears and tail well haired, the latter sharply bicolored; soles densely pilose posteriorly. Upper surface light broccoli brown; ears and upper side of tail hair brown; feet and under parts pure white. Length, 190 mm.; tail vertebræ, 90; ear above crown, 12; hind foot, 23. Skull, 29 by 14.5.

Cranial and dental characters.—The skull of this mouse (fig. 84) is at once distinguished from all other Texas mice of this genus by its larger size. The animal bears a superficial resemblance to the *P. arizonæ*, described by Dr. J. A. Allen, from Fairbank on the San Pedro River, in Arizona. Externally it is distinguished from that species by its paler coloration, slightly smaller ears, and stouter body. The largest skulls of *P. arizonæ* equal the average size of *P. tornillo*, but the teeth are smaller. The shape, however, is different. In both of these species the rostral portion is long and high, this character sufficing to distinguish them from any of the forms of *P. sonoriensis*. The skull of *P. tornillo* is low and squarish, with the superior profile but slightly arched, and its zygomatic arches standing strongly out in front, as sharp elbows at right angles to the cranial axis. The upper molar teeth of *P. tornillo* have the subsidiary cusps, especially those of the anterior upper molar more or less obsolete (fig. 85), whereas they are distinct in *P. arizonæ*.

The above description is based on fifteen adults taken near El Paso, Texas, in February and March. An immature female (No. $\frac{21058}{36100}$, U. S. N. M.) taken by the writer at Fort Hancock, Texas, June 16, 1893, is mouse gray where the juvenile coat is retained, the sides and forehead being smoke gray. Two specimens from the Upper Corner Monument (No. 40) are essentially like those from the vicinity of El Paso.

Habits and local distribution.—The Tornillo mouse is very abundant under groves of the screw bean in the Rio Grande River bottom. It was taken on both sides of the river, in Chihuahua and Texas. To the westward it was only found at Doyles Well (Monument No. 40), where two were taken. At Fort Hancock, Texas, a female contained four young on June 16, 1893.

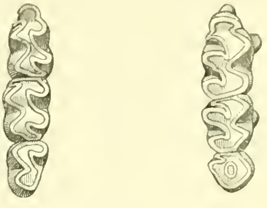

FIG. 85.—PEROMYSCUS TORNILLO. CROWNS OF MOLAR TEETH. *a*, LOWER SERIES; *b*, UPPER SERIES.

Measurements of 18 specimens of Peromyscus tornillo.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1892.		*mm.*	*mm.*	*mm.*	*mm.*
20019	35414	1457	El Paso, Texas	Feb. 18	♀ ad.	193	88	23.0	14.5
20025	35420	1458	.....do	....do...	♂ ad.	192	99	23.0	12.0
20020	35415	1459	.....do	....do...	♂ ad.	180	79	23.5	15.0
20023	35418	1460	.....do	....do...	♀ ad.	195	91	23.0	14.5
20024	35419	1479	.....do	Feb. 21	♀ ad.	164	72	22.0	11.0
20028	35423	1485	.....do	Feb. 22	♀ ad.	186	83	22.5	17.0
20026	35421	1486	.....do	....do...	♂ ad.	177	81	22.0	11.0
20021	35416	1500	.....do	Feb. 24	♀ ad.	181	81	24.0	15.0
20027	35422	1507	.....do	Feb. 25	♂ ad.	182	85	22.5	14.0
20032	35425	1515	.....do	....do...	♂ ad.	171	75	23.0	13.5
20029	....	1516	.....do	Feb. 26	♂ ad.	175	76	21.0	12.0
20030	35424	1517	.....do	....do...	♀ ad.	182	82	23.5	14.0
20022	35417	1518	.....do	....do...	♂ ad.	196	90	23.0	......
20031	....	1523	.....do	Feb. 27	♀ ad.	170	75	23.0	13.5
21167	37207	1544	Chihuahua, Mexico, near Monument No. 1, on the Rio Grande.	Mar. 15	♀ ad.	202	97	23.5	13.0
21165	37212	1758	100 miles west of the Rio Grande, upper corner Monument No. 40.	May 11	♂ ad.	175	78	22.0	13.0
21172	37231	1761	.....do	May 13	♀ ad.	177	82	22.0	13.0
				1893.					
21058	36100	2344	Fort Hancock, El Paso County, Texas.	June 16	♀ im.	180	80	23.0	14.0

PEROMYSCUS ARIZONÆ (Allen).

APACHE WOOD MOUSE.

Sitomys americanus arizonæ ALLEN, Bull. Am. Mus. Nat. Hist., VI, Art. XIII, Nov. 7, 1894, pp. 321, 322 (original description); VII, p. 229, June 29, 1895.

[*Peromyscus americanus*] *arizonæ*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 125 (Synop. Mam. N. Am.).

Peromyscus texanus arizonæ, MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 84 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus texensis*] *arizona*, ELLIOT, Field Col. Mus., Zool. Ser., IV, 1904, p. 186 (Mam. Mid. Am.).

Type-locality.—Fairbank, about 20 miles north of the Mexican Border, on the San Pedro River, in Cochise County, Arizona. (Type, skin and skull, in the American Museum of Natural History.)

Geographical range.—The habitat of *Peromyscus arizonæ* is the wooded banks of streams of the Elevated Central Tract. Specimens were taken on the San Bernardino, San Pedro, and Santa Cruz rivers, along the Boundary Line; and on the Verde River, in central Arizona. At present it is known only from the wooded streams of Sonora and Arizona, never having been taken in open or rocky country, away from water.

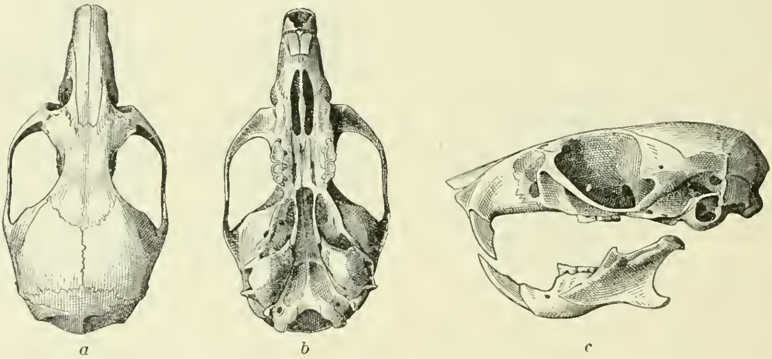

FIG. 86.—PEROMYSCUS ARIZONÆ. SKULL. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

Description.—A large, rather stout mouse. In winter the upper surface is tawny wood brown, mixed with gray and black; middle area above considerably darker than the sides; feet and under parts pure white; under pelage slate-gray; tail sharply bicolor, clove brown above, white below; ears scantily clothed, drab, without distinct hoary edging. In summer the coat is drab, lacking the tawny shade of winter; and the under surface shows much of the gray basal portion of the hair between the narrow points. The young are mouse gray, and may be born at any season of the year, those of winter having longer pelage than in summer. The mammæ are $\frac{1-2}{1-2}$. Length, 185 mm.; tail vertebræ, 85; hind foot, 23. Skull (fig. 86), 28 by 14.5.

Remarks.—The nearest relative of this species is the *Peromyscus tornillo*, from which it is separated, on the Boundary Line, by the San

Luis Mountains and scorched plains—impassable barriers to it. This mouse is probably of Mexican origin, and, south of the United States border, these two species (*P. tornillo* and *P. arizonæ*) may come together and intergrade, in which case *P. tornillo* would become a subspecies of *P. arizonæ*. The size of the two species is about the same, though *P. tornillo* appears to be the stoutest, and has a smaller ear, more massive skull, and larger teeth (see figs. 85 and 87), with a peculiarity of the anterior upper molar, in which the marginal intermediate subsidiary cusp is obsolete; and the coloration is much paler.

I have compared the specimens of this species in our collection with the type of *Sitomys americanus arizonæ* of Allen, and find that they are unquestionably the same.

Habits and local distribution.—In 1885 Doctor Merriam sent me a "delusion" mouse trap, which I set under some driftage beside the Verde River, Arizona, on September 23. The morning after it was missing, a curious raccoon having carried it off; but I followed the tracks of the raccoon and luckily recovered the trap, in which I caught two Arizona wood mice the next day. This was the beginning of my systematic mammal trapping and of my acquaintance with the present species, which I subsequently caught quite often in the cottonwood and willow groves bordering the Verde River. Some were also caught in the post hospital at Fort Verde. Two species of wild mice infested the hospital—the present species and *Peromyscus eremicus anthonyi*. Both were taken at the same time, in this same trap, set in a closet, in the hospital. On October 10, 1885, I found a nest of *Peromyscus arizonæ* in the hospital dispensary, in a drawer that was opened many times each day. The nest was composed of a small quantity of cotton and shreds torn from muslin bandages. It was soft, nicely felted, and altogether a snug little dwelling, in which I found a single mouse, just born, of bright pink color, and destitute of hair. This is the common mouse of the Verde Valley, ranging between 3,000 and 4,000 feet above sea level, in which range it associates with *Peromyscus eremicus anthonyi*. The higher mountains of this region are the habitat of *Peromyscus sonoriensis rufinus*. I did not find any form of the *Peromyscus boylii* group north of the Gila River, in Arizona.

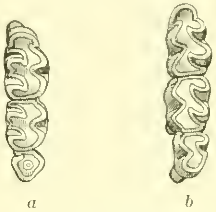

FIG. 87.—PEROMYSCUS ARIZONÆ. CROWNS OF MOLAR TEETH. *a*, UPPER SERIES; *b*, LOWER SERIES.

At the Morris ranch, on Clear Creek, near Fort Verde, on February 3, 1887, I discovered a nest of this mouse under a big stone in an alfalfa field. I put them in a box, together with some pocket-gophers (*Thomomys*). The gophers ate them all up, beginning at their tails. On May 14, 1887, I saw a mouse running about under the cottonwoods and grasped it in my hand. Its bite was quite severe. In its mouth were leguminous seeds smaller than those of the mesquite. Three females, taken at the Mexican town of Santa Cruz, Sonora, October 21 to 23, 1893, contained 4, 5, and 7 young, respectively.

Measurements of 50 specimens of Peromyscus arizonæ.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hindfoot and claw.	Ear from crown.
Skin.	Skull.								
				1885.	-	*mm.*	*mm.*	*mm.*	*mm.*
[a]1969	1343	244	Fort Verde, Arizona	Sept. 23	♂ ad.	178	86	21.5	14.0
[a]1346	1346	245	do	do	♀ juv.	152	65	20.0	12.0
[a]1971	1345	247	do	Sept. 26	♂ ad.	186	90	22.0	14.0
[a]1970	1344	248	do	do	♀ ad.	180	79	21.0	13.0
......	......	255	do	Oct. 3	♂ juv.	165	74	21.0	14.0
[b]2366	......	259	do	do	♂ ad.	167	77	21.0	14.0
[b]2367	10562	264	do	Oct. 12	♂ ad.	164	74	21.5	15.6
[b]2368	......	266	do	Oct. 15	♀ juv.	162	....	......	....
				1887.					
[b]2369	1815	528	do	May 14	♀ ad.	201	102	20.5	14.0
				1892.					
21168	36135	2129	San Pedro River, Monument No. 98	Oct. 15	♂ ad.	164	73	22.0	12.3
21170	36137	2146	do	Oct. 23	♂ ad.	173	76	22.5	12.5
21164	36133	2147	do	do	♀ juv.	146	62	21.0	11.5
21307	36163	2148	do	do	♀ ad.	189	87	22.3	15.3
21174	......	2154	do	Oct. 24	♂ juv.	140	63	......	.....
21166	36134	2166	do	Oct. 27	♂ ad.	170	75	22.7	12.0
20609	35769	759	do	Nov. 1	♀ ad.	202	94	23.5	17.0
20607	35767	764	do	Nov. 2	♀ im.	156	74	21.0	15.0
20601	35761	768	La Noria, near Monument No. 111 on Santa Cruz River, camp just south of Mexican line.	Nov. 8	♂ ad.	189	93	23.0	15.0
20627	35940	779	do	Nov. 9	♂ juv.	152	69	......	......
				1893.					
58794	58794	2572	East bank of Santa Cruz River, at a marshy spring, near Monument No. 111.	Oct. 20	♂ juv.	150	63	21.0	13.0
58764	58764	2574	Town of Santa Cruz, Sonora, near Monument No. 110.	Oct. 21	♂ ad.	165	71	23.0	13.0
58773	58773	2575	do	do	♂ ad.	182	83	24.0	14.6
58779	58779	2576	do	do	♀ ad.	193	85	22.7	15.0
58751	58751	2577	do	do	♂ im.	163	69	23.0	14.0
58753	58753	2585	do	Oct. 22	♂ ad.	189	86	23.0	14.0
58765	58765	2586	do	do	♀ ad.	188	83	22.5	14.0
58770	58770	2587	do	do	♀ ad.	189	84	22.0	15.0
58759	58759	2588	do	do	♀ im.	169	75	22.5	13.0
58763	58763	2589	do	do	♀ juv.	162	70	22.0	13.0
58780	58780	4594	do	do	♂ ad.	169	74	21.0	13.0
58769	58769	2595	do	do	♂ ad.	173	80	22.5	13.5
58760	58760	2596	do	do	♂ ad.	172	75	21.5	13.5
58775	58775	2597	do	do	♀ ad.	182	79	23.8	15.0
58797	58797	2604	do	Oct. 23	♀ ad.	178	78	22.0	14.0
58771	58771	2607	do	do	♂	163	68	22.8	14.0
58778	58778	2611	do	do	♂	174	77	23.0	13.7

[a] Collection of Dr. C. Hart Merriam.

[b] American Museum of Natural History.

Measurements of 50 specimens of Peromyscus arizonæ—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1893.		*mm.*	*mm.*	*mm.*	*mm.*
58776	58776	2616	Crossing of the Santa Cruz River near Monument No. 118	Oct. 24	♀ juv.	144	63	21.5	13.0
58777	58777	2617	.....do	....do...	♂ im.	164	74	22.5	14.0
58768	58768	2618	.....do	....do...	♀ im.	166	78	23.0	14.0
58787	58787	2619	.....do	....do...	♀ im.	157	67	22.0	11.5
58782	....	2634	Ruined mission of Tumacacori, near Tubac, on the Santa Cruz River, Arizona, near Monument No. 127.	Oct. 29	♀ juv.	172	78	21.5	12.0
58791	....	2635	.....do	....do...	♂ juv.	162	72	22.3	13.0
58809	58809	2637	.....do	....do...	♀ ad.	200	93	22.0	13.0
58805	58805	2639	.....do	....do...	♂ ad.	190	85	22.0	15.0
58761	58761	2646	20 miles south of Tucson on the Santa Cruz River, Arizona.	Oct. 30	♀ ad.	200	93	22.0	14.0
58786	58786	2647	.....do	....do...	♀ juv.	150	63	......	......
58755	58755	2648	Tucson, Santa Cruz River, Arizona...	Nov. 1	♂ ad.	177	80	22.5	13.7
58784	58784	2649	.....do	....do...	♂ ad.	160	71	21.8	12.1
58754	....	2650	.....do	....do...	♂ im.	167	75	21.5	12.0
58783	....	2651	.....do	....do...	♂ juv.	116	50	......	......

PEROMYSCUS BOYLII (Baird).

CALIFORNIA BRUSH MOUSE.

Hesperomys boylii Baird, Proc. Acad. Nat. Sci. Philadelphia, VII, p. 335, Apr., 1855 (original description); Mam. N. Am., 1857, p. 471, pls. VIII, fig. 3; pl. LII, fig. 3 (description and figures).

Peromyscus major Rhoads, American Naturalist, XXIX, pp. 831, 832, Sept. 1, 1893 (Squirrel Inn, San Bernardino County, California).

Peromyscus boylii, Mearns, Proc. U. S. Nat. Mus., XIX, p. 139, Dec. 21, 1896.—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 69 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus*] *boylii*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 132 (Synop. Mam. N. Am.); IV, 1904, p. 195 (Mam. Mid. Am.).

Type-locality.—Middle Fork of the American River, Eldorado County, California. (Type, skin—formerly mounted—and skull, Cat. No. $\frac{356}{1270}$, U. S. National Museum.)

Geographical range.—Upper Sonoran and Transition zones of the interior of California, reaching the coast in southern and Lower California.

Description.—Upper surface broccoli brown, tinged with cinnamon along cheeks, sides, and rump, and darkened on the back by black-tipped hairs; under surface and feet pure white; orbital area dusky; ears coated with short down of the same color as the surrounding parts; tail bicolor, clove brown above, white below. In winter specimens, the vertebral area is decidedly blackish, in which respect the typical forms differ from *P. boylii pinalis*, in which that part is paler and browner, and *P. boylii penicillatus*, in which the dark vertebral area has practically disappeared, the whole upper surface being pale grayish drab. The cinnamon-colored area of the sides is more restricted than in *pinalis* and the coloration in general darker, while *P. b. penicillatus* and *P. b. attwateri* are still paler forms. Mammæ, 3 pairs.

The young, which on the higher portions of the Coast Range are born in May, are one-half to three-fourths grown by the middle of June. They are at first mouse-gray above, darker about the orbit, and white below, where the gray basal portion of the coat can be discerned through the narrowly white-tipped hair. As they grow older they acquire a paler, more drab coloration. The adult coat is assumed in the usual way, the nape being the last place to receive the long coat, which, as usual, is darker and grayer at first, lacking the warm cinnamon color along the "water line." The young, like adults, can be identified by the penciled termination of the tail. The pelage of this form is dense and silky, like that of the members of the *P. sonoriensis* group.

A fine adult male from the eastern base of the Coast Range Mountains is paler and has much more of the cinnamon color than those from the summit and western slopes of these mountains. In this respect it agrees more closely than the rest of our series with the type of Baird's *boylii* and topotypes of Rhoads's *major*, these representing the form of the interior region of California, which is not so dark as that of the coast, in middle and northern California, which latter may be recognized as *Peromyscus boylii robustus* (Allen)[a]. Our specimens from west of the Coast Range are somewhat intermediate between true *boylii* and *robustus*, but they seem to me to be nearest to the former.

Measurements.—Average of eight adult males: Length, 201 mm.; tail vertebræ, 104; ear from crown, 14.9; length of hind foot, 22.1. Average of seven adult females: Length, 205 mm.; tail vertebræ, 110; ear from crown, 15.4; length of hind foot, 22.6. As usual, the females are a trifle larger than the males.

Cranial and dental characters.—The skull of the type (No. $\frac{1270}{356}$ U.S.N.M., skull and caudal vertebræ in fair condition) of *Hesperomys boylii* Baird measures 27.5 by 13.7 mm. It is indistinguishable from a series of skulls of this species from the coast region of southern California, when individuals of corresponding age (i. e., youngish adults) are compared. The characters of the skull and teeth are shown in the accompanying figure (fig. 88) of the type-specimen.

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[a] *Sitomys robustus* ALLEN, Bull. Am. Mus. Nat. Hist., V, Art. XIX, Dec. 16, 1893, pp. 335, 336. (Original description; type, skin and skull, from Lakeport, Lake County, California, in the American Museum of Natural History, New York.)

Local distribution.—The California brush mouse is an abundant inhabitant of brushy localities of the Pacific Coast Tract. It is commonly found in the chemizo thickets. Specimens taken at Nachoguero Valley, Lower California, and on the Laguna Mountains, California, June 8 and 15, 1894, contained 2 and 3 fetuses, respectively.

This elegant species, long since accurately described by Professor Baird, is typical of the group of brush mice, which are somewhat intermediate between the wood mice and desert mice. This group inhabits the Sonoran—usually only the Upper Sonoran—and Transition zones along the Mexican Boundary Line, from Texas to the Pacific; sometimes it penetrates the Lower Sonoran, or even crosses the Transition Zone, reaching the lower edge of the Boreal. A straggler was taken at the eastern base of the Coast Range Mountains, in California; one was taken at Mosquito Springs, Chihuahua (Monument No. 46); one was found quite low on the Franklin Range, in western Texas; and three were obtained at Fort Clark, Kinney County, Texas. These all came from the Lower Sonoran Zone, where, however, they are mere stragglers from the higher zones, the brush mice being inhabitants of brushy or forested mountains in the altitudinal zone between the habitats of the desert and plains mice and the habitat of the Arizona wood mouse (*Peromyscus sonoriensis rufinus*). On the Hachita, San Luis, San Jose, and Huachuca mountains the subspecies *pinalis* ranged from base to summit, and *P. sonoriensis rufinus* was not found; but in the Chiricahua, Mogollon, White, Graham, San Francisco, and other high ranges of mountains in Arizona and New Mexico *P. s. rufinus* occupies the Douglas spruce and aspen zone about the summits; and *P. boylii pinalis* is only found lower down, in the forest belts of pine, piñon, alligator juniper, cedar, and brushwood. As a rule, at least in the interior tract, the forms of *P. boylii* do not descend to the lowest valleys, even when these are wooded; and on the open country—the habitat of the desert mice (*Peromyscus eremicus* group) and plains mice (*Peromyscus sonoriensis* group)—it occurs only as an accidental straggler.

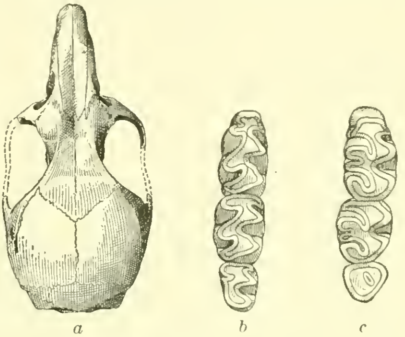

FIG. 88.—PEROMYSCUS BOYLII. SKULL AND TEETH OF TYPE. *a*, SKULL, DORSAL VIEW; *b*, CROWNS OF LOWER MOLARS; *c*, CROWN OF UPPER MOLARS.

Professor Baird's type of *Peromyscus boylii* was obtained on the Middle Fork of the American River, in Eldorado County, California, east of the San Joaquin Valley. It therefore represents a pale interior form of the species. Doctor Allen's *Peromyscus robustus* came from the mountainous region near the coast, and represents a somewhat darker form of *Peromyscus boylii*, which it may prove desirable to recognize, subspecifically, as a northern coast form.

Mr. Rhoads's *Peromyscus major*, from San Bernardino, California, is not recognizably distinct from *P. boylii*. The specimens of this species, collected by us on the east slope of the Coast Range, next to the Colorado Desert, agree with Baird's type of *P. boylii* and also with specimens from San Bernardino, California, the type locality of Rhoads's *P. major*. But from the west slope of the Coast Range we obtained a series of specimens that are somewhat darker in color, but not sufficiently different from typical *boylii* to merit separation as a race, being, in fact, much paler than Doctor Allen's type of *P. robustus*, which I have compared.

Measurements of 15 specimens of Peromyscus boylii.

Museum number.		Collector's number.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
60755	60755	1229	Mountain Spring, San Diego County, California, near Monument No. 230.	May 13	♀ ad.	205	116	23.0	16.5
61025	61025	1958	Eastern base of Coast Range Mountains, San Diego County, California.	May 8	♂ ad.	215	118	22.0	15.5
61050	61050	3595	Jacumba Hot Springs, San Diego County, California, near Monument No. 233.	May 28	♂ ad.	201	105	22.5	14.5
61053	61053	3608	.....do.....	May 30	♀ ad.	195	106	22.5	15.0
61056	61056	3611	Nachoguero Valley, Lower California.	June 1	♂ ad.	205	108	22.5	14.3
61057	61057	3612	.....do.....	....do...	♀ ad.	204	113	23.0	15.5
60781	60781	1384	.....do.....	....do...	♀ ad.	222	120	22.5	16.0
60790	60790	1419	.....do.....	June 8	♂ ad.	199	105	22.0	13.0
60795	60795	1461	Campbell's Ranch at Laguna, San Diego County, California.	June 15	♀ ad.	195	99	23	16
60798	60798	1477	.....do.....	June 18	♂ ad.	210	111	22.5	16.0
61061	61061	3648	.....do.....	June 12	♂ ad.	185	93	22.2	14.7
61062	61062	3649	.....do.....	....do...	♂ ad.	190	95	22.0	15.0
61064	61064	3663	.....do.....	June 15	♂ ad.	199	93	21.0	16.0
61065	61065	3665	.....do.....	June 16	♀ ad.	210	112	22.5	14.0
61067	61067	3688	.....do.....	June 20	♀ ad.	202	105	22.0	15.0

PEROMYSCUS BOYLII PINALIS (Miller).

APACHE BRUSH-MOUSE.

Sitomys rowleyi pinalis Miller, Bull. Am. Mus. Nat. Hist., V, Art. XVIII, Dec. 16, 1893, p. 331 (original description).

Peromyscus rowleyi pinalis, Allen, Bull. Am. Mus. Nat. Hist., VII, Art. VI, June 29, 1895, p. 227.

[*Peromyscus rowleyi*] *pinalis*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 135 (Synop. Mam. N. Am.).

Peromyscus boylii pinalis, MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 70 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus*] *rowleyi pinalis*, ELLIOT, Field Col. Mus., Zool. Ser., IV, 1904, p. 189 (Mam. Mid. Am.).

Type-locality.—Granite Gap, Grant County, New Mexico. (Type, skin and skull, in the collection of Gerrit S. Miller, jr.)

Geographical range.—Upper Sonoran and Transition zones of the Elevated Central Tract, in southern Arizona and New Mexico, and in the adjacent parts of Mexico.

Description.—Above pale grayish drab (sometimes buffy), darker and browner in the vertebral region; sides varying in different specimens from buffy drab to cinnamon; orbital area dusky; ears short-coated and colored like the surrounding parts; tail bicolor, hair brown above, white below, with a conspicuous terminal pencil. Young, slate-gray above, with the faintest possible tinge of fawn color on cheeks. The adult pelage is sometimes acquired on the under parts before the animal is more than one-half grown. Young are born throughout the year. Mammæ, 3 pairs.

Seasonal variation.—Examination of a series of more than 115 specimens, from the Elevated Central Tract of the boundary strip, in which every month from May to December is represented, shows the seasonal changes in coloration to be slight in comparison with those of some species of the genus *Peromyscus*. There is, however, a cinnamon-colored coat, acquired late in the summer, which appears quite different from the winter coat. This, however, is extremely evanescent, for it is scarcely acquired before it begins to be replaced by the winter pelage, which comes in from before backward on the upper surface. The winter coat of adults is always complete in November and December, and there is no change more than the wearing away of the tips of the hair and a general fading before June. A good series taken in May shows no indications of a spring moult; but in July or, sometimes, late in June, moulting begins, and the coat grows shabby and ragged. In August, which is still another month of change and shedding, the pelage receives a reddish cast as the transient summer coating comes to predominate late in the month, by which time some individuals are already receiving the drab winter coating. It is exceptional for one to appear with the completed summer coat, probably because the winter coat begins to replace that of summer before the latter has been perfected. By the end of September the drab winter coloring predominates, October specimens showing but slight traces of the more reddish summer pelage, and those taken in November none at all. It is, perhaps, unnecessary to add that the winter coat is longer, denser, and less rigid than that of summer, besides being more grayish.

Measurements.—Average of 55 adult males: length, 196.3 mm.; tail vertebræ, 105.8; length of hind foot, 21.2; ear from crown, 16.3. Average of 45 adult females: length, 198.1; tail vertebræ, 105.7; hind foot, 21.2; ear from crown, 16.2.

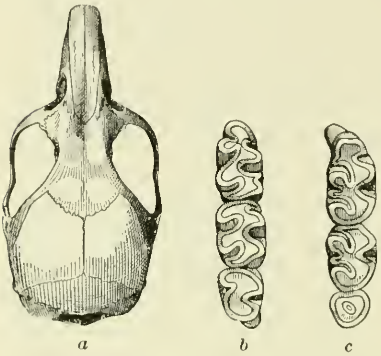

Fig. 89.—Peromyscus boylii pinalis. Skull and teeth. *a*, skull, dorsal view; *b*, crowns of lower molars; *c*, crowns of upper molars.

Cranial characters.—The skull (fig. 89) is appreciably broader and lower than that of typical *Peromyscus boylii*, with a much shorter and wider interpterygoid fossa. In size and other respects they are much the same, both having the nasals ending in a point, flush with the premaxillaries, posteriorly.

Remarks.—Eight specimens (Nos. 21531, 21594, 21605, 21602, 21586, 21611, 21606, and 21588, U.S.N.M.) from the Huachuca Mountains have white-tipped tails. The terminal white portion occupies from 10 to 50 mm. of the end of the tail. In five of the eight the whole tip of the tail is white, while the remaining three have the terminal pencil dark and a subterminal band of white. I have noticed a tendency in other alpine mammals, especially mice, to have white-tipped tails at the highest altitudes of their range. Another specimen of the present series (No. 21600, U.S.N.M.) has a small white spot on the rump, showing a further tendency to albinism. The white tail-tips are probably not due to freezing, as some specimens having white-tipped tails were too young to have experienced severe frosts prior to the date of their capture in early autumn. The hind foot is shown in fig. 90.

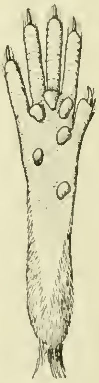

Fig. 90.—Peromyscus boylii pinalis. Lower surface of hindfoot.

Habits and local distribution.—The Apache brush mouse was found, as a straggler, at Mosquito Springs, Chihuahua. It was more abundant on the Hachita Grande Mountains, New Mexico, especially in the zone of piñon pine. Some were taken at medium elevations on the San Luis Mountains. On the San Jose and Huachuca Mountains it was abundant, and was obtained from the lower timber line to the actual summit of both ranges. Mr. Holzner obtained it in the Patagonia Mountains, and this species was the only one obtained in the Pajaritos Mountains during November and December, 1903, when it was scarce.

This mouse lives principally in thickets surrounding rocks and cliffs. It is chiefly nocturnal, but was sometimes taken in traps during the day. Pregnant females taken at Mosquito Springs, May 18, Huachuca Mountains, August 21 and 30, and Nogales, October 26, contained, respectively, 3, 2, and 3 fetuses. A female was suckling her young on June 27 in the San Luis Mountains.

Record and measurements of 127 specimens of Peromyscus boylii pinalis.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull								
				1892		mm.	mm.	mm.	mm.
21127	37200	1808	Mosquito Springs, Chihuahua, near Monument No. 46.	May 18	♀ ad.	205	107	22.0	20.0
21117	37202	1813	Hachita Grande, Grant County, New Mexico, near Monument No. 45.	May 22	♂ ad.	195	109	21.0	15.0
21114	37201	1815	.....do	May 25	♀ ad.	196	103	21.0	11.0
21129	37194	1832	.....do	June 3	♂ ad.	202	111	24.0	19.0
21125	37073	1911	San Francisco Canyon, east side of San Luis Mountains, near Whitewater, Chihuahua, Mexico, near Monument No. 64.	June 24	[a] ♂ ad.	......	......	21.5	14.0
21122	37074	1921	.....do	June 27	♀ ad.	198	107	23.0	......
21131	37075	2010	San Luis Canyon, west side of San Luis Mountains, near Monument No. 66.	July 11	♀ ad.	195	111	21.0	15.0
21123	37076	2013	.....do	July 19	♂ ad.	204	106	21.0	12.5
20752	37317	2114	San Jose Mountain, Sonora, near Monument No. 93.	Oct. 6	♂ ad.	200	111	22.0	21.0
20623	35932	797	La Noria, near Monument No. 111, on Santa Cruz River (camp just south of Mexico line).	Nov. 12	♂ juv.	172	90	22.0	16.0
20636	35782	805	Patagonia Mountains, Sonora, near Monument No. 112.	Nov. 16	[b] ♂ ad.	......	......	22.0	......
20630	35776	806	.....do	.....do	♂ ad.	200	108	21.0	18.0
20621	35775	807	.....do	.....do	♂ ad.	183	99	22.0	18.0
20631	35777	808	.....do	Nov. 17	♂ ad.	192	101	21.0	18.0
20632	35778	809	.....do	.....do	♂ im.	170	93	20.5	17.0
20639	35785	810	.....do	.....do	♂ im.	177	97	21.0	17.5
20637	35783	815	.....do	Nov. 18	♀ ad.	207	116	21.0	19.0
20634	35780	816	.....do	.....do	♂ ad.	185	105	21.0	17.0
20635	35781	817	.....do	.....do	♂ juv.	175	93	21.0	17.0
20641	35787	818	.....do	.....do	♀ juv.	157	82	20.5	17.0
20629	No skull.	819	.....do	.....do	♂ ad.	......	......	22.0	18.0
20638	35784	820	.....do	.....do	[a] ♂ ad.	......	......	21.0	17.5
20640	35786	821	.....do	Nov. 19	♀ ad.	195	104	20.5	17.0
20712	35826	826	.....do	Nov. 20	♂ im.	175	93	21.0	15.0
20716	35830	828	.....do	Nov. 21	♀ im.	180	99	20.0	16.0
20715	35829	829	.....do	.....do	♀ im.	189	105	21.5	16.5
20711	35825	830	.....do	.....do	♂ im.	176	91	19.5	15.0
20713	35827	831	.....do	.....do	[c] ♀ ad.	......	......	20.0	16.0
20714	35828	832	.....do	.....do	♂ im.	189	108	21.0	16.5
20717	35831	833	.....do	.....do	[d] ♂ ad.	......	......	20.5	16.0
20704	....	836	.....do	Nov. 22	♀ ad.	192	109	21.0	15.0

[a] Head and body, 93. [b] Head and body, 88. [c] Head and body, 97. [d] Head and body, 95.

Record and measurements of 127 specimens of Peromyscus boylii pinalis—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1893		*mm.*	*mm.*	*mm.*	*mm.*
21517	36711	883	Tanners Canyon, above the Post Garden, Huachuca Mountains, Arizona.	July 26	♂ ad.	190	106	20.5	15.0
21518	36712	884	do	do	[a] ♀ ad.	......	......	20.0	15.0
21519	36713	890	do	July 30	♂ ad.	189	103	20.5	17.5
21520	36714	894	do	Aug. 2	♀ ad.	208	115	22.0	16.5
21521	36715	899	do	Aug. 3	♀ ad.	194	107	20.0	16.5
21524	36716	900	do	do	♂ ad.	192	104	20.5	15.5
21525	36717	913	do	Aug. 5	♂ ad.	......	......	20.0	13.0
21526	36718	915	do	do	♀ ad.	199	106	21.5	16.0
21527	36719	923	do	Aug. 11	♂ ad.	191	103	21.0	15.0
21528	36720	924	do	do	♂ ad.	189	100	21.5	17.0
21529	36721	925	do	do	♂ ad.	201	111	21.0	16.5
21530	36722	929	do	Aug. 12	♂ ad.	190	99	20.5	16.0
21531	36723	930	do	do	♀ ad.	207	106	22.0	16.0
21532	36724	931	do	do	♀ ad.	190	101	21.0	17.0
21533	36725	932	do	do	♂ ad.	198	102	22.0	16.0
21534	36726	935	do	Aug. 13	[b] ♂ ad.	......	......	21.5	......
21535	36727	936	do	do	[c] ♀ ad.	......	......	21.0	15.5
21536	36728	941	do	Aug. 15	♂ ad.	181	92	20.0	18.0
21537	36729	942	do	do	♂ ad.	199	109	21.0	16.5
21538	36730	943	do	do	♂ ad.	177	87	21.0	15.0
21543	36732	951	do	Aug. 17	[c] ♂ ad.	......	......	21.0	16.0
21544	36733	952	do	do	♂ ad.	203	113	21.5	18.0
21545	36734	956	do	Aug. 21	♂ ad.	195	108	20.5	17.0
21546	36735	957	do	do	♂ ad.	188	103	21.0	17.9
21548	36737	959	do	do	♂ ad.	196	105	21.5	17.0
21549	36738	960	do	do	♀ ad.	200	112	22.0	17.0
21550	36739	961	do	do	♀ ad.	209	113	22.0	18.0
21551	36740	962	do	do	♀ ad.	193	101	20.5	16.5
21552	36741	963	do	do	♀ ad.	201	111	20.0	17.5
21553	36742	965	do	Aug. 22	♀ ad.	190	105	21.0	16.5
21554	36743	966	do	Aug. 23	♂ ad.	180	100	20.0	14.0
21555	36744	967	do	Aug. 22	♀ ad.	193	101	21.5	15.0
21556	36745	968	do	do	♀ ad.	190	104	21.0	13.5
21557	36746	969	do	do	♂ ad.	200	102	21.5	17.5
21560	37319	977	do	Aug. 25	♂ juv.	......	......	......	......
21561	36748	978	do	Aug. 26	♂ ad.	188	111	21.0	16.0
21563	36750	980	do	do	♀ ad.	189	99	20.0	16.0
21564	36751	981	do	Aug. 27	♂ ad.	186	97	21.0	16.0
21565	36752	982	do	do	♀ ad.	198	107	20.0	15.0
21566	36753	986	do	Aug. 28	♂ ad.	......	......	21.0	17.0
21567	36754	987	do	do	♀ ad.	206	113	21.0	18.0
21568	36755	992	do	Aug. 29	[d] ♀ ad.	......	......	21.0	16.0
21569	36756	993	do	do	♀ ad.	197	95	21.0	15.0
21570	36757	995	do	Aug. 30	♀ ad.	192	107	20.5	17.0
21576	36760	1003	do	Sept. 1	♂ ad.	206	118	22.0	......
21577	36761	1004	do	do	[d] ♀ ad.	......	......	21.0	15.5
21578	36762	1007	do	Sept. 3	♂ ad.	202	110	22.0	17.0
21579	37316	1012	do	Sept. 5	♀ ad.	198	104	21.0	16.0

[a] Head and body, 94. [b] Head and body, 95. [c] Head and body, 83. [d] Head and body, 92.

Record and measurements of 127 specimens of Peromyscus boylii pinalis—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1893.		*mm.*	*mm.*	*mm.*	*mm.*
21581	36763	1016	Tanners Canyon, above the Post Garden, Huachuca Mountains, Arizona.	Sept. 6	[a] ♀ ad.	......	......	22.0	15.0
21582	36764	1017	....do	....do...	[b] ♂ ad.	......	......	21.0	16.5
21584	36766	1019	....do	....do...	♂ ad.	188	97	21.0	16.0
21585	36767	1020	....do	....do...	♂ ad.	200	107	20.5	17.0
21587	36769	1022	....do	Sept. 7	♂ ad.	200	106	20.5	......
21588	36770	1023	....do	Sept. 9	♀ ad.	205	103	23.0	17.0
21590	36771	1026	Huachuca Mountains, at a spring near the summit, looking into Ramsay Canyon.	Sept. 12	[c] ♂ ad.	......	......	21.5	16.0
21591	....	1027	....do	....do...	♀ ad.	207	105	21.5	16.5
21592	36772	1028	....do	Sept. 13	[c] ♂ ad.	......	......	20.0	16.0
21593	36773	1029	....do	....do...	♀ im.	190	105	21.0	14.0
21594	36774	1030	....do	Sept. 14	♂ ad.	199	105	20.5	16.0
21595	36666	1031	....do	....do...	♀ ad.	192	102	20.5	16.5
21596	36775	1044	....do	Sept. 22	♂ ad.	199	104	22.5	15.0
21597	36776	1045	....do	....do...	♂ ad.	210	114	22.0	16.0
21598	36777	1046	....do	....do...	♂ ad.	191	102	21.0	15.9
21599	36665	1047	....do	....do...	♀ ad.	207	109	23.0	15.0
21600	36778	1049	....do	Sept. 23	♂ ad.	200	107	22.0	17.0
21601	36779	1050	....do	....do...	♂ ad.	202	106	22.0	16.0
21602	37072	1052	....do	Sept. 24	♂ ad.	195	102	21.0	15.0
21603	36780	1053	Small canyon running south from the spring, near the summit of the Huachuca Mountains, Arizona.	Sept. 25	♀ ad.	197	102	21.0	14.0
21605	36782	1056	....do	Sept. 28	♂ ad.	194	101	21.0	15.5
21606	36783	1057	....do	Sept. 29	♀ ad.	213	109	21.0	16.0
21607	36784	1058	....do	....do...	♀ ad.	206	113	22.0	17.0
21608	36785	1059	....do	....do...	[a] ♀ ad.	......	......	21.0	17.0
21610	36787	1061	....do	....do...	♀ ad.	195	99	20.5	......
21611	36788	1062	....do	....do...	♂ ad.	213	115	22.0	15.0
21612	36789	1064	Post Garden, Tanners Canyon, Huachuca Mountains, Arizona.	Oct. 3	♂ ad.	181	98	21.5	14.0
21614	36790	1071	....do	Oct. 4	♀ ad.	200	103	21.5	15.5
21615	36791	1072	....do	....do...	♀ im.	182	98	20.0	13.0
21617	36793	1074	....do	....do...	♂ ad.	205	117	21.5	16.0
21618	36794	1075	....do	....do...	♂ im.	180	99	21.0	15.0
21622	36798	1080	....do	Oct. 5	♀ ad.	201	102	21.0	17.0
21623	36799	1081	....do	....do..	♂ ad.	180	90	19.0	14.0
21625	36801	1083	....do	Oct. 6	♀ ad.	194	101	20.0	17.0
21626	36802	1084	....do	Oct. 7	♂ ad.	197	107	20.0	15.5
21627	36803	1085	....do	Oct. 8	♀ im.	197	109	20.0	14.0
58981	Alcoholic.	1087	....do	Oct. 9	♂ ad.	188	106	22.0	16.0
58880	58880	2125	Fort Huachuca, Arizona, near Monument No. 105.	July 26	♀ ad.	171	85	21.0	15.5

[a] Head and body, 94.
[b] Head and body, 95.
[c] Head and body, 97.

Record and measurements of 127 specimens of Peromyscus boylii pinalis—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hindfoot and claw.	Ear from crown.
Skin.	Skull.								
				1893.		*mm.*	*mm.*	*mm.*	*mm.*
58884	58884	2443	Summit of San Jose Mountains, Sonora, Mexico.	Aug. 7	♂ ad.	190	94	23.0	16.0
58883	58883	2441	.....do	....do...	[a] ♀ ad.	......	......	23.0	17.0
21522	37318	2449	.....do	Aug. 9	♂ ad.	198	102	22.0	17.0
21523	37320	2450	.....do	....do...	♂ ad.	198	102	22.0	16.0
58882	58882	2454	.....do	Aug. 10	♀ ad.	199	102	22.0	15.0
58798	58798	2622	Canyon of Pajaritos Mountains, about a mile west of Nogales, near Monument No. 223.	Oct. 26	♂ ad.	205	107	21.0	16.0
58806	58806	2623	.....do	....do...	♂ im.	175	88	20.0	15.0
58808	58808	2624	.....do	....do...	♀ im.	180	88	21.0	15.0
58795	58795	2625	.....do	....	♀ im.	193	97	21.5	15.5
59220	....	2668	Warsaw Mills, Pima County, Arizona, near Monument No. 132.	Dec. 1	♀ ad.	201	102	20.5	14.0

[a] Head and body, 105.

PEROMYSCUS BOYLII PENICILLATUS Mearns.

BAREFOOTED BRUSH MOUSE.

Peromyscus boylii penicillatus MEARNS, Proc. U. S. Nat. Mus., XIX, 1896, p. 139 (pp. 2, 3 of advance sheet issued May 25, 1896; original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 70 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus boylii*] *penicillatus*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 133 (Synop. Mam. N. Am.); IV, 1904, p. 196 (Mam. Mid. Am.).

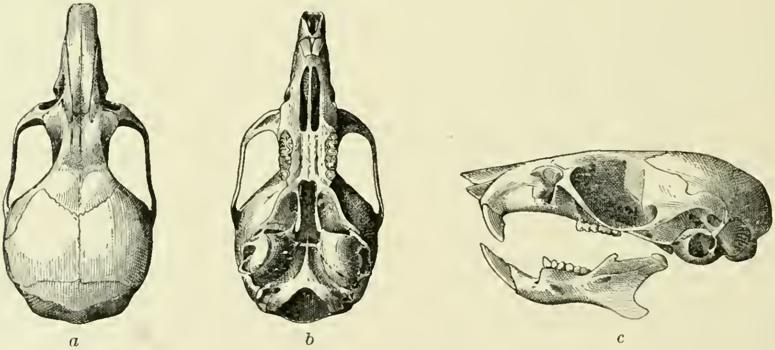

FIG. 91—PEROMYSCUS BOYLII PENICILLATUS. SKULL OF TYPE. *a*, DORSAL VIEW; *b*, VENTRAL VIEW *c*, LATERAL VIEW.

Type-locality.—Foothills of the Franklin Mountains, near El Paso, El Paso County, Texas. (Type, skin and skull, Cat. No. $\frac{20034}{35126}$, U. S. National Museum.)

Geographical range.—This subspecies is an inhabitant of the Eastern Desert Tract, its habitat being, doubtless, mainly in brushy or timbered hills, rising above the general level of the desert basins which make up this tract.

Description.—This is the palest subspecies of *Peromyscus boylii*, and differs from the more western forms in having the soles of the hind feet naked to the heel. The upper surface is drab-gray, tinged on sides and rump with ochraceous buff. Ears nearly naked, with a scant hoary pubescence. Tail dusky drab above, pure white below, penicillate, and rather hairy throughout. Feet and under parts pure white. The coloration is almost identical with that of *Peromyscus eremicus arenarius.* Length, 202 mm.; tail vertebræ, 115; ear from crown, 14; ear from notch, 18; length of head (nose to occiput), 31; length of hind foot and claw, 22. Skull, 28 by 14.

Cranial and dental characters.—The skull (fig. 91) is elongated, with the lengthened and depressed rostrum of typical *P. boylii* and *P. boylii pinalis*, but differs from them in having the nasal bones truncate posteriorly and ending considerably in front of the posterior extremities of the nasal branches of the premaxillaries instead of terminating in a point well behind them. The dentition (fig. 92) is very different from that of the *P. eremicus* group, and agrees with the members of the *P. leucopus* group in having a subsidiary loop or fold of enamel between the two principal loops at the outer side of the first and second upper molars.

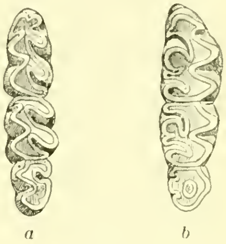

FIG. 92.—PEROMYSCUS BOYLII PENICILLATUS. CROWNS OF MOLAR TEETH OF TYPE. *a*, LOWER SERIES; *b*, UPPER SERIES.

Remarks.—The type was taken in a thicket at the base of a cliff beside the Rio Grande. I saw a similar mouse in Cataract Creek Canyon, Arizona.

PEROMYSCUS BOYLII ATTWATERI (Allen).

ATTWATER BRUSH MOUSE.

Peromyscus attwateri ALLEN, Bull. Am. Mus. Nat. Hist., VII, Art. X, Nov. 8, 1895, pp. 330, 331 (original description); VIII, Art. V, Apr. 22, 1896, p. 65 (Lacey's Ranch, Kerr County, Texas).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 68 (Syst. Results Study N. Am. Mam. to close of 1900).—ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 135 (Synop. Mam. N. Am.); IV, 1904, p, 192 (Mam. Mid. Am.).

Type-locality.—Turtle Creek, Kerr County, Texas. (Type, skin and skull, in the American Museum of Natural History.)

Geographical range.—Elevated portions of Middle Texas, in the Sonoran zone. Hills of Kerr and Kinney counties.

This dark-colored form of *Peromyscus boylii* was described by Dr. J. A. Allen from a series of specimens from round about San Antonio, Texas, collected by the indefatigable Attwater. In describing it, I can not do better than transcribe Doctor Allen's original description:

> Above tawny brown, darker and much mixed with blackish along the median dorsal area, more golden on the sides, the lower edge of the dorsal area forming a strongly-defined golden lateral line. Below pure white, the base of the fur plumbeous. Fore feet white to slightly above the wrists; hind feet white nearly to the tarsal joint, soles naked nearly to the heels. Ears very large, nearly naked, dusky, faintly edged with whitish. Tail sharply bicolor, dusky above, grayish below, moderately well haired (the annulations showing through more or less toward the base), and generally well tufted at the end.
>
> *Measurements.*—Average of 10 adult specimens, measured in flesh: Total length, 196 (187–216) mm.: tail vertebræ, 100 (96–110): hind foot, 21 (20–23); ear from notch (measured from the skins), 16 (15–17). The type, a breeding female, is rather above the average of the series, measuring as follows: Total length, 216; tail vertebræ, 110; hind foot, 23; ear, 17.
>
> Skull (of type), total length, 28; basilar length, 26; greatest cranial breadth, 14; least interorbital breadth, 5; length of nasals, 9.5.
>
> This species is based on a series of 14 specimens collected on Turtle Creek, Kerr County, Texas, May 24, 1894, and March 9–13, 1895, and on 3 from San Geronimo Creek, Medina, County, Texas, April 23, 1895. Several are in the nearly uniform dark-gray pelage of the young, others are more advanced, but still immature, while about one-half are "young" adults, only a few being "old" adults. One only (the type) has a very small spot of bright fulvous on the breast.
>
> *Peromyscus attwateri* finds its nearest affines in *Peromyscus rowleyi* and *P. eremicus*, but seems to be clearly different from either.
>
> This species is named for the collector, Mr. H. P. Attwater. (Bull. Am. Mus. Nat. His. VII, p. 330.)

Description of young.—A young specimen in gray pelage, taken December 31, 1892, at Fort Clark, Kinney County, Texas, by the author, and identified as this mouse by Doctor Allen, is mouse-gray above, and white below, It is beginning to receive the longer coat, appearing first on the chest. An older specimen, taken at the same place, January 12, 1893, is more advanced, having the adult coating on the ventral surface and a colored line on the side. One taken two days earlier has the colored coat throughout, but is duller than adults, the upper surface being hair-brown. The feet of the three Fort Clark specimens are as naked below as those of *Peromyscus boylii penicillatus;* and, like that subspecies, and also *P. eremicus*, the nasals are truncate, ending in front of the premaxillaries.

Habits and local distribution.—The Attwater brush mouse finds its home in high ground, in brushwood, where there are crevices in the rocks. It is seldom found in woods near the streams.

Measurements of 3 specimens of Peromyscus boylii attwateri.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hindfoot and claw.	Ear from crown.
Skin.	Skull.								
				1892.		*mm.*	*mm.*	*mm.*	*mm.*
21147	37150	2181	Fort Clark, Kinney County, Texas.	Dec. 31	♀ juv.	167	83	22.0	16.0
				1893.					
21150	37151	2189	.....do	Jan. 10	♂ im.	170	86	22.0	14.5
21151	37152	2193	.....do	Jan. 12	♀ juv.	168	85	22.0	14.5

PEROMYSCUS MARTIRENSIS (Allen).

SAN PEDRO MARTIR BIG-EARED MOUSE.

Sitomys martirensis Allen, Bull. Am. Mus. Nat. Hist., V, Art. XII, Aug. 18, 1893, p. 187 (original description).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec., 27, 1901, p. 78 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus*] *martirensis*, Elliot, Field Col. Mus., Zool. Ser., IV, 1904, p. 189 (Mam. Mid. Am.).

Type-locality.—San Pedro Martir Mountains, Lower California, altitude 7,000 feet. (Type, skin and skull, in the American Museum of Natural History.)

Geographical range.—Upper Sonoran and Transition zones of the mountains of southern and Lower California.

Description.—The following is taken from Dr. J. A. Allen's original description of this species:

> Similar in coloration and in the size and character of the ears to *S. truei*, but with longer tail and less heavily clothed soles. Above grayish fulvous or pale yellowish brown, finely varied with blackish; sides washed with bright tawny, forming a broad lateral line. Below pure white, the basal portion of the fur blackish plumbeous, with sometimes a wash of tawny on the middle of the breast. A narrow blackish eye ring; feet white to above the carpal and tarsal joints; ears dusky, nearly naked; tail sharply bicolor, above blackish (in one specimen intense black), grayish white below, well haired and terminating in a heavy pencil, the vertebræ alone rather longer than head and body.
>
> *Measurements.*—Total length, 195 mm.; tail to end of vertebræ, 102 (average of 4 specimens measured by the collector before skinning); terminal pencil, 5; ear from crown, 16; ear from notch, 20; hind foot, 22 (last 4 measurements from the skins).
>
> Skull, total length, 28 mm.; basilar length, 23.4; greatest zygomatic breadth, 12.7.
>
> This species is based on 4 specimens, 2 males and 2 females, all fully adult, collected in the San Pedro Martir Mountains, at an altitude of 7,000 feet, May 6, 1893, by Mr. A. W. Anthony They are very uniform in size and coloration.
>
> *Sitomys martirensis* apparently finds its nearest relative in *Sitomys megalotis* (Merriam) which it closely resembles in size and coloration, but has smaller ears. (Bull. Am. Mus. Nat. Hist., V, p. 187.)

Two specimens of *Peromyscus martirensis* in the Mexican Boundary collection (No. 61033, U.S.N.M. and No. $\frac{8081}{6438}$, Amer. Mus. Nat. Hist.) were taken May 17, 1894, in San Diego County, California, close to the

Mexican Border. No. 61033 (figs. 93 and 94), an adult female, furnished the following measurements, taken from the fresh specimen by the author: Length of head and body, 93 mm.; ear from crown, 19.2; length of hind foot, 23; longest whisker, 50. Skull, 29 by 14. No. $\frac{8081}{6438}$, an adult male, measured: length, 203 mm.; tail vertebræ, 115; ear from crown, 19; length of hind foot, 23. The ears are of enormous size and nearly naked. Tail well haired and sharply bicolor. Soles of feet hairy at the heel. Whiskers very long, extending back of the shoulders. Pelage long, dense, and silky. Feet and under parts pure white, with a trace of an ochraceous pectoral patch, as in the type of *P. truei*. Vent rusty. Ears dark purplish brown, coated only with sparse, downy hairs. Above yellowish drab, grayer on the muzzle and nape, thicky lined with dusky annuli and tips to the hairs, and bordered by a line of ochraceous buff extending along the sides from the cheeks to the rump.

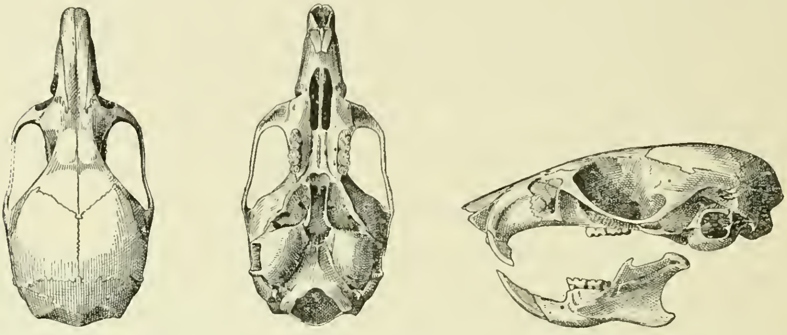

FIG. 93.—PEROMYSCUS MARTIRENSIS. SKULL. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

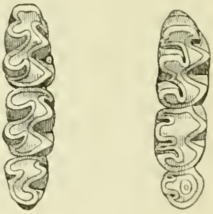

FIG. 94.—PEROMYSCUS MARTIRENSIS. CROWNS OF MOLAR TEETH. *a*, LOWER SERIES; *b*, UPPER SERIES.

Remarks.—This huge-eared mouse, though closely related to *Peromyscus truei* (Shufeldt) is apparently distinct. It is about the same size. The type of *P. truei*, a very old male specimen, is distorted, having the skin bunched up in such a manner that it is impossible to obtain by measurement an approximation to its original size. It presents the following dimensions: Tail, 76 mm. (to end of pencil, 86); ear from notch (about), 21; hind foot, 21; longest whisker, 48. It is of much the same color as typical *Peromyscus eremicus*. The pelage is very long, dense, and silky, the fur measuring 16 mm. in length on the back. The ears are flesh-colored and sparsely coated with short grayish down. The dorsum is a mixture of drab and ochraceous buff finely mixed with black. The color is given by the tips of the hairs, between which the slate-colored basal portion of the hair appears to some extent. The sides are ochraceous buff. Feet and under parts, white. The densely haired tail is sharply bicolored; clove brown above, white on sides and below. Whiskers mostly colorless, but mixed with black. Soles of feet very hairy. The skull measures 29 mm. in total length; basilar length (Hensel), 22.3; zygomatic breadth 15.2. It belonged to a very aged individual, and is a little longer and relatively much broader than two skulls of *Peromyscus martirensis* that we collected on the Boundary Line in a pass at the summit of the Coast Range Mountains, which, though fully adult, are not so mature as that of the type of *P. truei*. The skull of *P. martirensis* measures: Total length (occipito-nasal), 28.2 mm.; zygomatic breadth, 13.8; basilar length (Hensel), 21.2.

Comparing these specimens with the type of *P. truei*, the ears appear to be about the same size. The colors of *P. martirensis* are very much darker, owing to the blackish annulation of the drab fur of the upper surface. Only a narrow line between the grayish drab upper parts and the white under parts is ochraceous buff. There is a faint trace of ochraceous on the breast of *P. truei*, and also on these specimens of *P. martirensis*. The ears are more darkly colored, but as scantily clothed as those of *P. truei*. The fur, though fine and soft, is coarser than that of *P. truei* and considerably shorter, with the tail less hairy. The difference in coloration between *P. truei* and *P. martirensis* is closely paralleled by typical *P. eremicus* and *P. eremicus fraterculus* of corresponding regions.

As would be supposed, the specimens from the Mexican Border, several hundred miles north of the type-locality of *Peromyscus martirensis*, depart somewhat from the typical form and approach the form to the northward which Doctor Allen[a] has named *Peromyscus gilberti*. It is not, however, exactly intermediate, but in coloration is paler than either *P. martirensis* or *P. gilberti*, and so correspond with the subspecies *medius* of *P. sonoriensis*.

PEROMYSCUS STEPHENSI Mearns.

PALM DESERT MOUSE.

Peromyscus stephensi MEARNS, Proc. U. S. Nat. Mus., XIX, 1897, p. 721 (original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 83 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus*] *stephensi*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 136 (Synop. Mam. N. Am.); IV, 1904, p. 190 (Mam. Mid. Am.).

Type-locality.—Lowest water, on the wagon road, in a canyon, at the eastern base of the Coast Range Mountains, San Diego County, California, near the Mexican Boundary Line. (Type, skin and skull, Cat. No. 61026, U. S. National Museum.)

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[a] Bull. Am. Mus. Nat. Hist., V, Art. XII, Aug. 18, 1893, pp. 188–190

Geographical range.—Lower California Tropical or Palm Tract, along the east base of the Coast Range Mountains.

Description.—Similar externally to *Peromyscus eremicus* (Baird), but smaller, with a longer tail and much paler coloration. Upper surface grayish cream buff, deepening to pale ochraceous buff on sides and rump; tail slightly dusky above, white below, hairy at end; feet and under surfaces white; whiskers mostly colorless; ears and soles naked, the former slightly pubescent. Length, 193 mm.; tail vertebræ, 108 (to end of pencil, 114); ear from crown, 16; ear from notch, 18.5; length of head, 26.5; length of hind foot, 19. Skull, 23 by 11.5.

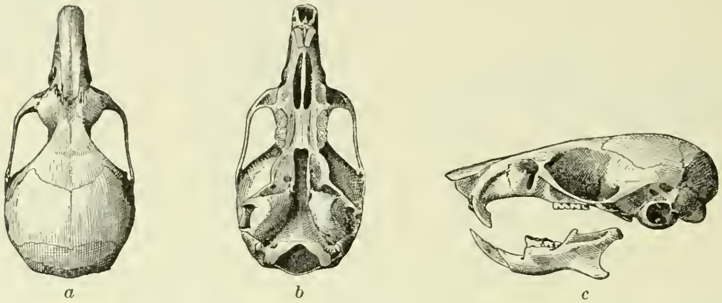

FIG. 95.—PEROMYSCUS STEPHENSI. SKULL. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

Cranial and dental characters.—The skull (fig. 95) is strongly depressed anteriorly, with the rostrum produced and the nasals projecting. The zygomatic arches are incurved and convergent anteriorly to meet the sloping zygomatic processes, this feature recalling the configuration of young skulls of the other species of *Peromyscus*, in which the brain case has outgrown the face, though in this case we have the opposite condition, the facial portion being unusually elongated. In *P. stephensi* the profile of the skull is nearly straight above, declining to the front. The skull is remarkably narrow interorbitally. The teeth are shown in fig. 96.

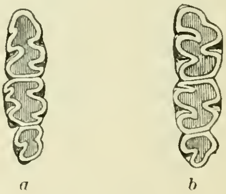

FIG. 96.—PEROMYSCUS STEPHENSI. CROWNS OF MOLAR TEETH *a*, LOWER SERIES; *b*, UPPER SERIES.

Remarks.—A specimen of this species in the American Museum collection ($\frac{5895}{4524}$ male adult, old) agrees in all respects with the type, and was collected at Palm Springs, San Diego County, California (Colorado Desert), February 19, 1893, by Mr. F. Stephens, for whom the species is named. "Total length, 181; tail vertebræ 110; hind foot, 19." *Peromyscus eremicus* occurs with the present species at Palm Springs.

Local distribution.—The type was caught May 8, 1894, among granite bowlders at the first water in the canyon through which the wagon road crosses the Coast Range Mountains by way of Mountain Spring, in San Diego County, California, at the east base of the mountains. Others were taken, farther north, by Mr. Frank Stephens. This species was not met with later, although we trapped assiduously at Mountain Spring and to the westward.

Subgenus HAPLOMYLOMYS Osgood.

Haplomylomys Osgood, Proc. Biol. Soc. Wash., XVII, pp. 53, 54, fig. 1, March 21, 1904.

Type.—*Peromyscus eremicus* (Baird), from Fort Yuma, California.

Characters.—Size medium or small; pelage usually very soft and silky; tail longer than head and body, subterete, rather thinly haired; soles of hind feet naked (at least in median line) to calcaneum, 6-tuberculate and paved with minute imbricate scales; skull with cranium rather large and rostral region relatively weak; first and second upper molars with three salient and two reëntrant outer angles at all stages of wear; small secondary tubercles never present between outer primary tubercles; lower molars correspondingly simple. (Proc. Biol. Soc. Wash., XVII, p. 53.)

PEROMYSCUS CALIFORNICUS INSIGNIS (Rhoads).

SOUTHERN PARASITIC DESERT MOUSE.

Peromyscus insignis Rhoads, Proc. Acad. Nat. Sci. Phila., 1895, pp. 33, 34 (original description).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 76 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus*] *insignis*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 138 (Synop. Mam. N. Am.); IV, 1904, p. 203 (Mam. Mid. Am.).

Type-locality.—Dulzura, San Diego County, California. (Type in the collection of S. N. Rhoads.)

Geographical range.—Sonoran Zone of the Pacific Coast Tract of southern and Lower California.

Description.—*Peromyscus californicus* belongs strictly to the group of Desert Mice, typified by *Peromyscus eremicus* (Baird), which are characterized by bare soles, long, tapering, scant-haired tails, large membranous ears, flattened skulls, with shortened rostrum and posteriorly truncate, advanced nasal bones, and teeth (fig. 98, p. 430) having the subsidiary marginal cusps reduced to the merest trace—only a step removed from the *Onychomys* form, in which the notches are smooth, without a trace of these minor cusps. The southern subspecies (*insignis*) differs from the typical form (*californicus*) in being larger, paler, and grayer, without the brown vent and fulvous suffusion of throat and breast characteristic of northern specimens.

This is the largest species of *Peromyscus* found in the United States (for measurements, see page 431). Its appearance suggests a small *Neotoma*, which resemblance is strengthened by its large, nearly naked, highly sensitive membranous ears, which in life are in as constant motion as its nose. Its proportions are similar to those of the other members of the desert mice group. The tail is more hairy than usual, the hairs increasing in length from base to tip, those of its under surface being much shorter than above; its color clove-brown above, sometimes white and sometimes dusky below, usually without a line of demarkation between. Body above, brownish gray, coarsely mixed with black, grayish on the head, gradually changing to tawny cinnamon on sides, rump, and outer surface of limbs. As in *Peromyscus merriami*, the dark coloring of the outer surface of fore limbs extends down to the wrist. The feet are white, except that the dark coloring often extends down on the basal third of the dorsum of pes, as in *Neotoma micropus*. The under surface is sometimes wholly white, but more often with a pectoral spot of cinnamon or fawn-color on the chest, this, when present, varying from a trace to a large patch. Sometimes there is a colored patch on the throat. The orbital region is dusky. Topotypes (from Dulzura, California) are darker, more mixed with black above in winter than in summer.

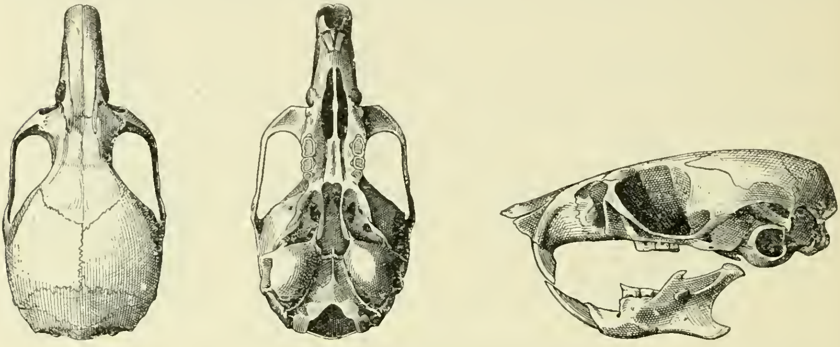

Fig. 97.—Peromyscus californicus insignis. Skull. *a*, dorsal view; *b*, ventral view; *c*, lateral view.

A young specimen, taken at La Jolla, on the edge of the Pacific, February 10, 1892, by Mr. F. Stephens, was one-third grown at the date of capture. This, the youngest specimen in the series of 40 before me, is smoke-gray above, and has a faint drab staining on the sides, and the barest indication of the pectoral patch; below white, exhibiting much of the gray basal portion of the hair between the narrowly white tips.

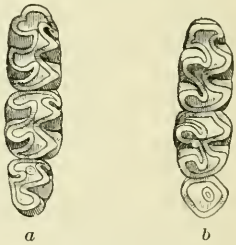

Fig. 98.—Peromyscus californicus insignis. Crown of molar teeth. *a*, lower series; *b*, upper series.

Cranial characters.—There are but two skulls of northern *P. californicus* in the U. S. National Museum. One of these (No. $\frac{2039}{1157}$) is labeled "Santa Clara," in Professor Baird's handwriting; and the other (No. $\frac{23297}{14481}$) was collected at Baird, in northern California, by Mr. C. H. Townsend. These are rather young, and slightly smaller than specimens of *P. c. insignis* of the same age. The nasals are a little shorter in the northern specimens; but I can discern no other difference of importance. The alleged difference in the form of the frontal bones referred to by Mr. Rhoads[a] is due to difference of age in the specimens examined. The skull and teeth of *P. c. insignis* are shown in figs. 97 and 98.

Habits and local distribution.—This large mouse is an inhabitant of rocky places where bushes and oak trees grow. Young in the gray coat were obtained at Tecate, in Lower California, June 28, 1894; and a female, containing two large young, was taken the same day.

Measurements of 14 specimens of Peromyscus californicus insignis.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
60780	60780	1382	Jacumba San Diego County, California, near Monument No. 233.	June 1	♀ ad.	231	127	25	......
61048	61048	3579	.....do	May 21	♂ ad.	226	125	25	21
61049	61049	3594	.....do	May 28	♂ ad.	211	131	26	21
61058	61058	3613	Nachoguero Valley, Lower California.	June 1	♀ ad.	223	120	23.5	20
60783	60783	1388	.....do	June 2	♂ ad.	226	121	21	17
60784	60784	1392	.....do	June 3	♂ ad.	231	125	26	20.7
60785	60785	1391	.....do	.....do	♂.	217	115	21	20
60786	60786	1398	.....do	June 4	♀.	212	114	23.5	20.5
60792	60792	1416	.....do	June 5	♂.	217	120	25	20
61069	....	3695	Tecate River, southeast of Tecate Mountain, Lower California, near Monument No. 246.	June 26	♂ ad.	240	136	25.5	21
60803	60803	1502	.....do	June 25	♂ ad.	228	125	25	20
60802	60802	1512	.....do	June 26	♂.	210	112	......	......
61087	....	3748	San Isidro ranch, Lower California, near Monument No. 250.	July 2	♂ im.	209	111	25.5	18
61098	61098	3776	Jamul Creek near El Nido P. O., San Diego County, California.	July 8	♀ im.	......	120	25	19

PEROMYSCUS EREMICUS (Baird).

WESTERN DESERT MOUSE.

Hesperomys eremicus Baird, Mam. N. Am., 1857, pp. 479, 480 (original description); Rep. U. S. and Mex. Bound. Surv., II, Pt. 2, Mam., 1859, p. 44.

Peromyscus eremicus, Allen, Bull. Am. Mus. Nat. Hist., VII, p. 226, June 29, 1895.—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, p. 72 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus*] *eremicus*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 136 (Synop. Mam. N. Am.); IV, 1904, p. 191 (Mam. Mid. Am.).

Type-locality.—Old Fort Yuma, San Diego County, California. (Co-types in the U. S. National Museum.)

Geographical range.—Tropical and lower Sonoran zones of the Western Desert Tract.

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[a] Proc. Acad. Nat. Sci. Phila., 1895, p. 34.

This species, including its several subspecies, was found by us on the Boundary Line from the Rio Grande at El Paso, Texas, to the edge of the Pacific Ocean, and a related insular form was collectd on Tiburon Island, in the Gulf of California, by Mr. J. W. Mitchell. The species was originally described by Professor Baird from specimens collected by Maj. G. H. Thomas and Mr. Arthur Schott, a naturalist of the earlier Mexican Boundary Survey, in the vicinity of Fort Yuma, on the California side of the Colorado River. During the recent survey of the Mexican Line we obtained a good series of topotypes of *Peromyscus eremicus* from Fort Yuma, San Diego County, California, from Yuma, Arizona, and from the Colorado River bottom below the mouth of the Gila River, on both sides of the Colorado River. These were compared with Professor Baird's types of *eremicus* (especially No. "1334. Colorado Bottom, Cal. A. Schott"), and found to be the same. Having definitely determined the form of this species, which Baird described as *Hesperomys eremicus*, it has been possible to describe other species and subspecies of the desert-mice group, and to assign geographic ranges to the subspecies of *P. eremicus* inhabiting the Boundary Line strip.

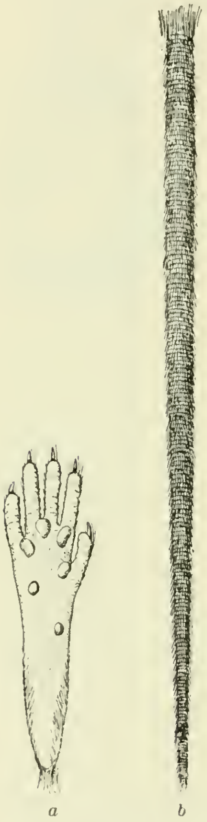

FIG. 99.—PEROMYSCUS EREMICUS. *a*, HIND FOOT; *b*, TAIL.

It would be difficult to frame a better description of the external characters of this beautiful species than Baird gave in his original account of it, but he neglected to say anything respecting its skull and teeth, though the cranial and dental characters of the group of desert mice typified by *Peroymscus eremicus* are very characteristic. Mr. Gerrit S. Miller, jr., in his description of the subspecies *fraterculus*[a], directed attention to the peculiar form of the nasals and their relations to the premaxillary and frontal bones, together with the peculiar shape of the brain case. Still later the writer described[b] characteristic differences in the tuberculation and in the enamel pattern of the grinding surface of the middle and anterior molar teeth.

Description.—In the typical form (subspecies *eremicus*) the soles of the hind feet (fig. 99*a*) are naked to the heel; tail (fig. 99*b*) longer than head and body, not distinctly bicolor, slender, scantily haired, and tapering to a fine point; ears large, nearly naked, thin, membranous, and exceedingly sensitive. Color above grayish drab, tinged with ochraceous, and not much darkened by black-tipped hairs; sides, cheeks, and rump ochraceous buff; top of head paler and grayer than the back, which has no dark vertebral area; feet and under parts pure white. In winter the coloring is darker than in summer.

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[a] American Naturalist, XXVI, p. 261.

[b] Proc. U. S. Nat. Mus., XIX, 1896, p. 138 (p. 2 of advance sheet issued May 25, 1896).

The young retain the gray coloring with which they are born until they are two-thirds grown, when a coating of ochraceous and drab, duller than that of adults, but otherwise much the same, is gradually acquired, appearing at first as a dull ochraceous band along the sides, extending over the back at a later period. Five of these young desert mice, in the mixed pelage of the young and adult, were described by Doctor Merriam[a] as a distinct species—"*Hesperomys* (*Vesperimus*) *anthonyi*"—with the statement that three of them were adults, and that "in coloration, proportions, and cranial characters this mouse differs so radically from all previously known species that comparison with others is unnecessary." Fortunately, the name *anthonyi* can stand for the larger and darker subspecies of *Peromyscus eremicus* inhabiting the Elevated Central Tract between the eastern and western deserts.

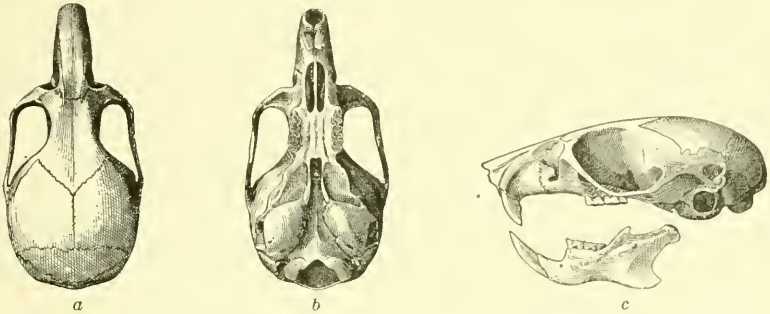

FIG. 100.—PEROMYSCUS EREMICUS. SKULL. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

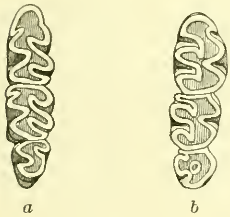

FIG. 101.—PEROMYSCUS EREMICUS. CROWNS OF MOLAR TEETH. *a*, LOWER SERIES; *b*, UPPER SERIES.

Cranial and dental characters.—The skull (fig. 100) is low and flat, with a short rostrum and truncate nasals ending posteriorly considerably in front of the hinder extremities of the premaxillaries. The brain case, though short and flattened, is not so to the exaggerated degree of *P. auripectis*, in which it is almost disk shaped. The outer borders of the first and second upper molars have but three salient and two reentrant loops or enamel folds (fig. 101).

Habits and local distribution.—We found this handsome desert mouse abundant from the Sonoyta River Valley to the western edge of the Colorado desert, where, at the eastern slopes of the Coast Range Mountains, it blends into the subspecies *fraterculus*. Those specimens of this species from east of Sonoyta are referred to the subspecies *anthonyi*. It prefers rocky places and requires less moisture than the members of the plains-mice group. At Sonoyta and Quitobaquita it abounded in the huts and brush fences of the Papago and Mexicans. Some nests of grass, feathers, and stems and leaves of plants were found in the fences. A nest containing four young was placed in a box. The mother followed and entered the box. In my tent she was again liberated, but returned to her progeny in the box. This mouse appeared very slender and light when compared in the flesh, with *Peromyscus merriami* and the latter was always found in fields and never in houses.

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[a] Proc. Biol. Soc. Wash., IV, Apr. 15, 1887, pp. 1-3.

The western desert mouse was quite common on the lower Gila and Colorado rivers, though much less numerous than the plains mouse. Its range did not extend to the low savannas about the mouth of the Colorado River, where *Peromyscus sonoriensis deserticola* is most abundant. Seven pregnant females were examined January 9 to April 15, the young numbering 4, 4, 3, 1, 4, 2, and 3.

Record and measurements of 62 specimens of typical Peromyscus eremicus.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
59240	59240	2779	Sonoyta, Sonora, Mexico, near Monument No. 167.	Jan. 15	♀ ad.	205	114	22.0	16.5
63303	......	2780 to 2783	....do	....do...	(a)	......	......	......	.....
59257	59257	2803	....do	Jan. 20	♂ ad.	195	109	20.0	14.0
59255	59255	2804	....do	....do...	♀ im.	184	98	21.6	15.0
59239	59239	2806	....do	....do...	♂ ad.	200	111	20.3	14.0
59247	59247	2809	....do	Jan. 21	♂ juv.	184	96	20.6	14.0
59253	59253	2810	....do	....do...	♂ juv.	178	98	20.0	14.5
59246	59246	2811	....do	....do...	♀ ad.	196	106	19.7	16.5
59245	59245	2825	....do	Jan. 23	♂ ad.	......	......	21.0	14.0
141851	37170	2848	Quitobaquita, Pima County, Arizona, near Monument No. 172.	Jan. 28	♂ ad.	191	103	20.0	16.5
59776	59776	2857	....do	Jan. 30	♂ ad.	183	97	19.5	16.0
59770	59770	2858	....do	....do...	♂ ad.	189	107	21.5	17.0
59777	59777	2859	....do	....do...	♂ ad.	190	96	221.0	11.0
59778	59778	2860	....do	....do...	♂ ad.	208	123	20.0	14.0
59769	59769	2861	....do	....do...	♀ ad.	190	105	20.8	15.0
59772	59772	2862	....do	....do...	♂ ad.	188	103	21.0	16.5
59782	59782	2863	....do	....do...	♀ ad.	199	110	20.0	15.0
59784	59784	2864	....do	....do...	♂ ad.	199	108	21.5	13.0
59780	59780	2865	....do	....do...	♂ ad.	192	108	21.0	16.0
141853	37171	2866	....do	....do...	♀ juv.	......	......	......	.....
59775	59775	2839	....do	Jan. 31	♂ im.	188	104	20.0	15.5
61528	(b)	2880	....do	Feb. 1	♀ ad.	195	108	20.0	17.0
141854	37172	2891	....do	Feb. 2	♂ juv.	191	103	20.0	16.5

[a] Four young of No. 2779.

[b] Alcoholic.

Record and measurements of 62 specimens of typical Peromyscus eremicus—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hindfoot and claw.	Ear from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
59783	59783	2892	Quitobaquita, Pima County Arizona, near Monument No. 7.	Feb. 3	♂ ad.	198	111	20.0	15.0
59771	59771	2893	.....do	...do...	♀ ad.	190	103	20.7	16.0
59773	59773	2909	.....do	Feb. 4	♂ ad.	204	116	20.0	17.0
59779	59779	2910	.....do	...do...	♂ ad.	205	115	21.0	16.5
59774	59774	2930	.....do	Feb. 6	♀ im.	187	104	19.9	15.0
59786	59786	2951	Tule Wells, Yuma County, Arizona, near Monument No. 185.	Feb. 12	♂ ad.	191	103	19.8	15.0
59785	59785	2952	.....do	...do...	♂ ad.	191	105	20.2	15.0
59787	59787	2964	Range of granite mountains 3 miles west of Tule Wells, Arizona, Monument No. 177.	Feb. 13	♂ ad.	197	109	22.0	15.0
141856	37174	2965	.....do	...do...	♂ im.	179	98	20.0	15.5
59763	59763	2971	Tinajas Altas, Yuma County, Arizona, Monument No. 192	Feb. 16	♂ ad.	195	106	20.8	15.5
59765	59765	2972	.....do	...do...	♀ ad.	199	112	21.0	17.0
59766	59766	2973	.....do	...do...	♀ ad.	207	112	20.5	16.0
59764	......	2974	.....do	...do...	♂ im.	188	104	20.8	15.0
59767	59767	2985	.....do	Feb. 17	♂ ad.	186	102	20.0	16.2
141857	37175	2986	.....do	Feb. 18	♀ im.	174	105	19.0	16.0
59768	59768	3008	.....do	Feb. 20	♂ ad.	183	101	20.3	16.0
59759	59759	3017	Adonde Station, S. P. R. R., Yuma County, Gila River, Arizona.	Feb. 26	♀ ad.	197	104	21.0	15.0
59762	59762	3049	.....do	...do...	♀ ad.	([a])	......	21.0	16.0
59756	59756	3051	.....do	...do...	♂ ad.	196	110	21.3	15.0
59760	59760	3052	.....do	...do...	♀ ad.	198	108	21.0	16.7
59754	59754	3059	.....do	Feb. 27	♂	190	105	20.5	13.0
59757	59757	3060	.....do	...do...	♂	181	97	20.0	14.5
59761	59761	3068	.....do	Feb. 28	♀ im.	175	99	20.2	14.0
60167	60167	3111	Yuma, Arizona, Monument No. 207.	Mar. 12	♂ juv.	165	88	20.0	14.5
60094	60094	3119	Colorado River, at Monument No. 204.	Mar. 15	♀ ad.	182	95	20.0	16.0
60095	60095	3120	.....do	...do...	♂ ad.	171	89	20.0	15.0
60096	60096	3121	.....do	...do...	♂ ad.	175	91	21.0	16.0
60092	60092	3144	.....do	Mar. 16	♀ ad.	177	99	21.0	16.0
60152	60152	3148	.....do	...do...	♀	159	94	20.0	15.0
60102	60102	3188	.....do	Mar. 17	♂ im.	169	88	21.0	17.5
60100	60100	3279	.....do	Mar. 25	♂ ad.	181	99	21.0	17.0
60166	60166	3283	.....do	Mar. 26	♀ ad.	195	107	......	17.0
60080	60080	3313	.....do	Mar. 27	♂ ad.	176	95	20.5	17.0
60081	60081	3314	.....do	...do...	♀	158	85	19.0	15.5
60169	60169	3475	Fort Yuma, San Diego County, California.	Apr. 2	♀ ad.	193	103	21.0	16.0
60170	60170	3476	.....do	...do...	♀ juv.	129	65	......	.....
60172	60172	3483	.....do	Apr. 3	♂ ad.	186	96	20.0	16.0
60173	60173	3484	.....do	...do...	♂ juv.	135	70	......	.....
60747	60747	1135	Seven Wells, Salton River, Colorado Desert, Lower California, Monument No. 213.	Apr. 15	♀ ad.	179	98	19.0	17.0

[a] Head and body, 86.

PEROMYSCUS EREMICUS FRATERCULUS (Miller).

SAN DIEGO DESERT MOUSE.

Sitomys fraterculus MILLER, American Naturalist, XXVI, Mar., 1892, pp. 261, 264 (original description).

Sitomys herronii RHOADS, American Naturalist, XXVII, pp. 832, 833, Sept. 1, 1893 (type-locality, San Bernardino Valley, southern California).

Sitomys herroni nigellus RHOADS, Proc. Acad. Nat. Sci. Phila., 1894, pp. 257, 258 (type-locality, West Cajon Pass, San Bernardino Mountains, California).

[*Peromyscus*] *fraterculus*, TROUESSART, Catal. Mam., Pt. 3, 1897, p. 515.—ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 136 (Synop. Mam. N. Am.); IV, 1904, p. 184 (Mam. Mid. Am.).

Peromyscus fraterculus, MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 73 (Syst. Results Study N. Am. Mam. to close of 1900).

Type-locality.—Dulzura, San Diego County, California. (Type in the collection of Gerrit S. Miller, jr.)

Geographical range.—Sonoran Zone of the Pacific Coast Tract of southern and Lower California.

Description.—Larger and darker than typical *Peromyscus eremicus;* underparts with a muddy staining, whereas the more eastern forms of *P. eremicus* have the under surface pure white unless there is a pectoral spot of cinnamon. Its general resemblance to *P. californicus*, except in size, suggested the name *fraterculus.* As stated by Mr. Rhoads, in the American Naturalist for September, 1893, "Mr. Miller, who described *fraterculus* as a full species, now considers it a 'dark coast form of *eremicus*.'"

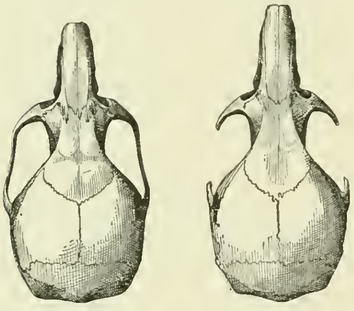

FIG. 102.—PEROMYSCUS EREMICUS FRATERCULUS. SKULLS. *a*, TYPE OF SITOMYS HERRONII RHOADS (= SITOMYS FRATERCULUS MILLER); *b*, TYPE OF SITOMYS HERRONI NIGELLUS RHOADS (= SITOMYS FRATERCULUS MILLER).

The coloration, as a whole, is darker than in the other subspecies of *P. eremicus*; the upper surface being liberally mixed with black-tipped hairs; under surface grayish white, stained with clay color, often with a spot of cinnamon on the chest; sides tawny cinnamon instead of ochraceous buff; tail nearly naked except near the end, dusky below, not at all bicolored. In typical *eremicus* the under side of the tail is decidedly paler than the upper, but without any line of demarcation; while the subspecies *arenarius* has the tail practically bicolored, its under surface being pure white.

In the Coast Range Mountains, where the winters are cold, the young of the first litter are born about March and mature about August. Near the coast, where there is uniformity of temperature, they breed indiscrimnately throughout the year. The first pelage is slate-gray above and grayish white below, where the whitish points on the hairs are very narrow. When two-thirds grown, the adult pelage is assumed coincidently with the occurrence of the molt, which begins on the under surface, extends thence to the sides, whence a median extension is produced upward until it meets the opposite side and completes the girdle, appearing above as a narrow band across the middle of the back, but covering all of the under surface from the neck to the inguinal region. The coating then extends to the limbs and head, the dorsal band broadening until only a small spot on the nape and another on the upper part of the rump remain—the last to be covered by the new hairs. In immature specimens the coloring is duller than in adults.

This subspecies grows paler in the notches and on the eastern slope of the Coast Range, where intergradation with typical *P. eremicus* begins. At Mountain Spring, halfway up the eastern slope of the Coast Range Mountains, we obtained specimens almost as pale as typical *P. eremicus*, with nearly white underparts, though most specimens from there were nearer to *P. e. fraterculus*. Mr. S. N. Rhoads has described the intergrade between subspecies *eremicus* and *fraterculus*, from the San Bernardino Valley, California, under the name *Sitomys herronii*, and true *Peromyscus eremicus fraterculus* was afterwards redescribed by him as *Sitomys herronii nigellus*, from West Cajon Pass, San Bernardino Mountains, southern California. I am indebted to Mr. Rhoads for an opportunity of examining these types (figs. 102 and 103) and of comparing them with the series of desert mice in the U. S. National Museum.

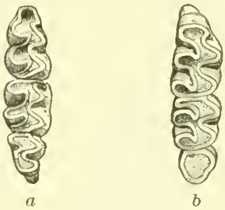

FIG. 103.—PEROMYSCUS EREMICUS FRATERCULUS. CROWNS OF MOLAR TEETH. TYPE OF SITOMYS HERRONII RHOADS (= SITOMYS FRATERCULUS MILLER). *a*, LOWER SERIES; *b*, UPPER SERIES.

Local distribution.—This mouse was common in the Pacific Coast Tract, living in dry places among bushes and rock. Four females, taken May 13 to June 8, would have given birth to 2, 3, 4, and 4 young, respectively.

Record and measurements of 21 specimens of Peromyscus eremicus fraterculus.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
60745	60754	1227	Mountain Spring, San Diego County, California, Monument No. 230.	May 13	♀ juv.	......	......	......	......
60756	60756	1231	.....do	....do...	♀ ad.	190	114	20.0	18.0
60757	60757	1237	.....do	May 14	♀ juv.	167	89	......	......
60758	60758	1249	.....do	May 15	♂ ad.	193	110	21.0	17.0
61027	61027	1962	.....do	May 10	♂ ad.	193	104	20.5	......
61028	61028	1963	.....do	....do...	♂ juv.	168	89	20.0	13.3
61029	61029	3515	.....do	May 11	♀ ad.	197	110	20.5	15.2
61031	61031	3521	.....do	May 16	♀ ad.	193	107	21.0	15.0
61032	61032	3522	Summit of Coast Range Mountains.	May 17	♂ ad.	180	97	20.3	14.5
61034	61034	3533	Jacumba, San Diego County, California, near Monument No. 233.	May 18	♂ ad.	200	108	20.0	14.3
60765	60765	1294	.....do	May 20	♂ ad.	188	100	21.0	14.0
60775	60775	1350	.....do	May 27	♂ ad.	192	102	21.0	16.5
61038	61038	3542	.....do	May 19	♂ ad.	195	102	21.0	16.5
61043	61043	3567	.....do	May 23	♂ ad.	182	94	20.2	15.0
60791	60791	1421	Nachoguero Valley, Lower California.	June 8	♀ ad.	192	104	20.5	14.3
60800	60800	1499	Tecate River, southeast of Tecate Mountain, Lower California, near Monument No. 246.	June 25	♂ ad.	191	112	19.5	16.5
61092	61092	3761	Jamul Creek, near El Nido post-office, San Diego County, California.	July 4	♂ ad.	190	103	21.0	15.0
61093	61093	3762	.....do	....do...	♂ juv.	......	......	......	......
61094	61094	3763	.....do	....do...	♂ juv.	......	......	......	......
61323	61323	3769	San Isidro ranch, Lower California, near Monument No. 250.	July 3	♂ juv.	......	......	......	......
60806	60806	1580	Jamul Creek, near El Nido post-office, San Diego County, California.	....	....	201	109	20.0	16.0

PEROMYSCUS EREMICUS ANTHONYI (Merriam).

APACHE DESERT MOUSE.

Hesperomys (*Vesperimus*) *anthonyi* Merriam, Proc. Biol. Soc. Wash., IV, pp. 1, 3, Apr. 15, 1887 (original description, based on a young individual with long ochraceous hair on the sides).

[*Peromyscus*] *anthonyi*, Trouessart, Catal. Mam., Pt. 3, 1897, p. 517.—Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 141 (Synop. Mam. N. Am.); IV, 1904, p. 185 (Mam. Mid. Am.).

Peromyscus anthonyi Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1., Dec., 27, 1901, p. 68 (Syst. Results Study N. Am. Mam. to close of 1900).

Āwāy Măl'-ē of the Hualapai Indians.

Pow-wip-seha of the Hopi Indians.

Type-locality.—Camp Apache, Grant County, New Mexico, near Monument No. 40. (Type, skin and skull, Cat. No. $\frac{2333}{2841}$, U. S. National Museum.

Geographical range.—Sonoran Zone of the Elevated Central or Apache Tract, between the Eastern and Western deserts.

Description.—This slight geographical race of *Peromyscus eremicus* differs from the typical form in being larger, darker with brighter ochraceous coloration, and smaller ears. From the varied character of its habitat this subspecies is less uniform in size, coloration, and proportions than the other forms of *eremicus*. In specimens from the strip of country between the Mimbres Valley and the San Luis Mountains the ear is decidedly smaller than that of typical *eremicus*. West of the San Luis Mountains the ear increases in size and the coloration, as a rule, is darker. In the canyons at the head of the Yaqui River a small, dark-colored phase was found which may prove to be worthy of separation as a subspecies if further differentiated in the lower Yaqui River tract. In this connection I have examined two specimens from Oposura, Sonora (Nos. 8816 and 8817, collection of the American Museum of Natural History, New York), forwarded to me by Dr. J. A. Allen. These are the darkest ones seen, and somewhat larger than two from Guadalupe Canyon (Nos. 58878 and 58879, U.S.N.M.) on the International Line at the head of the Yaqui. These four are much like *P. tiburonensis*, a species inhabiting Tiburon Island, in the Gulf of California, near the mouth of the Yaqui River. The skull is shown in fig. 104.

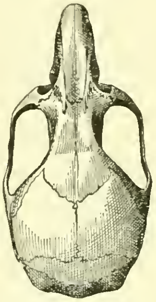

FIG. 104.—PEROMYSCUS EREMICUS ANTHONYI. DORSAL VIEW OF SKULL.

Habits and local distribution.—When camped near Wheatfield, Arizona, October 21, 1884, I set out in company with Gen. George Crook in search of Whitney owls (*Micropallas whitneyi*). Several giant cacti were chopped down, and in a hole in one of them we found a soft nest containing two of these mice, one of which, an old female, was caught. On the following day we found more of them under old logs of cottonwood in a camp on Tonto Creek. It lived and built nests in closets and drawers of my quarters at Fort Verde, in Central Arizona. On the Mexican Boundary Line it was first taken at Monument No. 15, where it was restricted to bushy places and rocky buttes, none having been taken on the level sandy ground where most of our trapping was done. This form of the desert mouse continued westward in abundance in similar situations to the Sonoyta Valley of Sonora. It was sometimes found with *Peromyscus boylii pinalis*.

Measurements of 58 specimens of Peromyscus eremicus anthonyi.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hindfoot and claw.	Ear from crown.
Skin.	Skull.								
				1892.		mm.	mm.	mm.	mm.
20253	35620	1561	Monument No. 15, south of Wragg's ranch.	Mar. 22	♀ ad.	190	102	22.0	15.0
21120	37238	1569	....do....	Mar. 23	♂ ad.	193	103	20.5	16.0
20252	35593	1570	....do....	....	♂ ad.	203	110	20.5	15.0
20245	35565	1585	....do....	Mar 26	♂ ad.	189	95	21.0	15.0
20246	35615	1586	....do....	....do....	♂ ad.	182	92	20.5	15.5
20243	35611	1619	....do....	Apr. 2	♀ ad.	184	95	20.0	14.0
20242	35618	1620	....do....	....do....	♂ ad.	175	89	20.5	15.0
20254	35555	1634	....do....	Apr. 4	♀ ad.	......	105	21.0	14.5
20251	35601	1647	....do....	Apr. 6	♀ ad.	188	100	22.0	13.0
20255	35550	1648	....do....	....do....	♂ ad.	187	97	21.0	14.0
20249	35558	1670	Near Carrizalillo Springs, New Mexico, Upper Corner Monument No. 40.	Apr. 17	♀ ad.	179	95	21.0	18.0
20241	35623	1692	100 miles west of the Rio Grande.	Apr. 25	♂ ad.	186	102	22.0	15.0
20250	35626	1693	....do....	....do....	♀ ad.	184	97	21.5	15.5
20248	35574	1700	....do....	Apr 26	♀ ad.	193	100	20.0	15.0
20244	35610	1705	....do....	Apr. 27	♂ ad.	177	94	20.0	14.0
21128	37232	1716	....do....	Apr. 30	♀ ad.	181	90	20.0	15.0
21119	37230	1717	....do....	....do....	♂ ad.	181	90	21.2	15.5
21124	37206	1720	....do....	May 1	♀ ad.	182	92	20.2	14.0
21126	37227	1733	....do....	May 4	♀ ad.	188	96	21.5	16.0
21116	37241	1742	....do....	May 7	♀ ad.	179	93	19.5	15.0
21118	37248	1748	....do....	May 8	♂ ad.	185	93	21.0	14.0
21121	37229	1751	....do....	May 9	♂ ad.	192	100	21.0	15.0
21132	37148	1824	Dog Spring, Grant County, New Mexico, near Monument No. 55.	June 1	♀ ad.	191	104	20.0	18.5
21173	36139	2160	San Jose Mountain, Sonora, Monument No. 98, on the San Pedro River.	Oct. 26	♀ im.	155	84	20.0	14.0
				1893.					
58879	58879	2466	Hall's Ranch, Guadalupe Canyon.	Aug. 26	♂ ad.	175	91	20.0	16.0
58878	58878	2467	....do....	....do....	♀ im.	175	94	20.0	......
58885	58885	2515	Dog Spring Grant County, New Mexico, Monument No. 55.	Sept. 21	♀ ad.	184	89	21.0	14.0
58804	58804	2636	Ruined Mission of Tumacacori, near Tubac, on the Santa Cruz River, Arizona.	Oct. 29	♀ juv.	175	90	20.0	19.0
58790	58790	2638	....do....	....do....	♂ ad.	192	97	21.0	15.0
58802	58802	2640	....do....	....do....	♀ ad.	206	106	22.3	15.5
58807	58807	2641	....do....	....do....	♂ ad.	214	114	21.7	18.0
				1884.					
2360[a]	1816	142	Tonto Creek, Arizona	Oct. 22	♀ ad.	205	100	20.0	16.0
2365[a]	In skin.	143	....do....	....do....	♀ juv.	144	66	......	......
				1885.					
2364[a]	Missing.	269	Fort Verde, Arizona	Oct. 20	♂ ad.	180	92	20.0	16.0
2361[a]	....	271	....do....	Oct. 24	♂ ad.	185	95	21.0	17.0
	....	272	....do....	....do....	♀ ad.	175	95	20.0	17.0
12184[a]	....	274	....do....	Oct. 28	♂ ad.	165	......	20.0	16.0
2362[a]	....	292	....do....	Dec. 28	♂ ad.	195	105	20.0	17.0
12185[a]	In skin.	305	....do....	Dec. 31	♀ ad.	183	92	20.0	15.0

[a] American Museum of Natural History.

Measurements of 58 specimens of Peromyscus eremicus anthonyi—Continued.

Museum number. Skin.	Museum number. Skull.	Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
				1887.		*mm.*	*mm.*	*mm.*	*mm.*
2369[a]	1815	528	Fort Verde, Arizona	May 14	♀ ad.	196	90	22.0	17.0
	....	529	.....do...........................	June 27	♂ juv.	164	70	21.5	14.0
				1888.					
2363[a]	....	654	....	Apr. 23	♀ ad.	195	97	21.0	18.0
				1893.					
58803	58803	2658	Fort Lowell, Pima County, Rillito Creek, Arizona.	Nov. 20	♂ ad.	193	107	21.0	17.5
58792	....	1110	.....do...........................	Nov. 13	♀ ad.	196	110	22.0	19.0
59163	59163	2705	La Osa, Pima County, Arizona, Monument No. 140.	Dec. 19	♀ im.	176	92	21.7	16.0
59169	59169	2706	.....do...........................	Dec. 20	♀ ad.	181	93	21.0	15.0
59161	59161	2707	.....do...........................	....do....	♂ ad.	188	102	21.0	16.5
59167	59167	2714	.....do...........................	Dec. 21	♀ ad.	......	......	20.5	15.5
59219	59219	2715	.....do...........................	....do....	♂ ad.	199	109	21.5	17.0
59164	59164	2716	.....do...........................	....do....	♂ ad.	179	95	21.0	15.0
59218	59218	2719	.....do...........................	....do....	♂ ad.	187	106	20.0	16.0
59170	59170	2722	.....do...........................	Dec. 22	♀ ad.	183	92	20.0	14.5
59165	No skull.	2723	.....do...........................	....do....	♀ juv.	165	90	21.0	15.0
59217	....	2751	Pozo de Luis, Sonora, Mexico.	Dec. 30	♂ im.	175	96	20.0	13.2
				1894.					
59248	59248	2752	.....do...........................	Jan. 1	♀ ad.	191	103	20.7	15.0
59243	59243	2753	.....do...........................	....do....	♂ juv.	176	96	20.0	16.0
59250	59250	2756	.....do...........................	Jan. 3	♀ ad.	204	110	24.0	17.0
59256	59256	2761	.....do...........................	Jan 4	♂ ad.	183	99	20.0	15.0

[a] American Museum of Natural History.

PEROMYSCUS EREMICUS ARENARIUS Mearns.

EASTERN DESERT MOUSE.

Peromyscus eremicus arenarius MEARNS, Proc. U S. Nat. Mus., XIX, 1896, p. 138 (p. 2 of advance sheet issued May 25, 1896; original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 73 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus eremicus*] *arenarius*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 136 (Synop Mam. N. Am.); IV, 1904, p. 191 (Mam. Mid. Am.).

Raton of the Mexicans.

Type-locality.—Bank of the Rio Grande, about 6 miles above El Paso, El Paso County, Texas. (Type, skin and skull, Cat. No. $\frac{20018}{35413}$, U. S. National Museum.)

Description.—Similar to typical *Peromyscus eremicus*, but paler, with the pelage grayer and more silky, and the ears smaller. The upper surface is pale ochraceous drab finely mixed with black, without a darker median area; ears almost naked, but with a slight pubescence on the convex surface; tail dusky drab mixed with hoary above, pure white below; under parts and feet pure white. The head is somewhat grayer, and there is a dusky orbital ring.

Cranial and dental characters.—The skull is longer and narrower in front than in the more western forms of *P. eremicus,* with the rostrum somewhat longer. The outer border of the anterior and middle upper molars have but three salient and two reentrant loops or enamel folds, as is usual in the group of desert mice. The subsidiary (often paired) marginal cusps, usually present in *Peromyscus,* are obsolete in the *eremicus* group; and they are wholly wanting in the genus *Onychomys. Peromyscus eremicus* affords another striking illustration of the difference in the mammal forms of the Eastern and Western Desert tracts.

Habits and local distribution.—The eastern desert mouse was found in abundance about El Paso, where it lived among rocks, cacti, and agaves, on both sides of the Rio Grande, specimens having been taken from Texas and Chihuahua. Salt pork and oatmeal were attractive bait.

Measurements of 21 specimens of Peromyscus eremicus arenarius.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hindfoot.	Ear from crown.
Skin.	Skull.								
				1892.		*mm.*	*mm.*	*mm.*	*mm.*
20036	35427	1412	El Paso, Texas	Feb. 3	♂ ad.	182	98	21.0	16.0
20035	35471	1415	.....do	Feb. 5	♂ ad.	169	87	21.0	14.0
20037	35472	1424	.....do	Feb. 8	♂ ad.	197	105	21.0	14.0
20013	35409	1456	.....do	Feb. 18	♀ ad.	187	95	21.0	16.5
20012	35408	1464	.....do	....do	♂ ad.	187	103	21.0	15.0
20011	35407	1469	.....do	....do	♀ ad.	182	95	21.0	15.5
20016	35412	1470	.....do	....do	♀ ad.	183	96	20.0	15.0
20038	35428	1471	.....do	....do	♂ ad.	191	100	21.0	14.0
20014	35410	1478	.....do	Feb. 21	♂ ad.	181	92	20.5	14.0
20008	35405	1483	.....do	Feb. 22	♂ ad.	194	112	20.5	15.5
20015	35411	1484	.....do	....do	♂ ad.	191	101	21.5	14.0
20007	35404	1492	.....do	Feb. 23	♀ ad.	184	105	19.5	13.0
20004	35401	1493	.....do	....do	♀ ad.	184	100	22.0	15.0
20005	35402	1497	.....do	Feb. 24	♂ ad.	186	94	20.0	15.0
20009	....	1498	.....do	....do	♂ ad.	189	96	21.0	14.0
20010	35406	1499	.....do	....do	♀ ad.	200	107	21.0	14.0
20017	37109	1512	.....do	Feb. 25	♀ ad.	200	111	21,0	15.0
20018	35413	1513	.....do	....do	♂ ad.	198	106	21.5	15.0
20006	35403	1514	.....do	....do	♂ ad.	191	106	21.0	15.0
20033	35481	1526	.....do	Feb. 29	♂ ad.	199	98	21.0	15.0
21115	37205	1545	Chihuahua, Mexico, near Monument No 1, on the Rio Grande.	Mar. 15	♂ ad.	184	96	20.0	14.0

PEROMYSCUS MERRIAMI Mearns.

SONOYTA DESERT MOUSE.

Peromyscus merriami MEARNS, Proc. U. S. Nat. Mus., XIX, 1896, p. 138 (p. 2 of advance sheet, issued May 25, 1896; original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, Dec., 1901, p. 79 (Syst. Results Study N. Am. Land Mam. to close of 1900).

[*Peromyscus*] *merriami*, ELLIOT, Field Col. Mus., Zool. Ser., IV, 1904, p. 198 (Mam. Mid. Am.).

Type-locality.—Village of Sonoyta, on the Sonoyta River, State of Sonora, Mexico. (Type, skin and skull, Cat. No. 59234, U. S. National Museum.)

Geographical range.—The Sonoyta desert mouse is known only from the Sonoyta River, Sonora, near the Boundary Line between Mexico and the United States.

Description.—This species has the appearance of the *Peromyscus eremicus*, living in the same locality,[a] except that it is larger and stouter. The two have the same coloration, except that *P. merriami* is somewhat darker, has the light cinnamon color extending down the outer side of the fore limb to the hand, and a large pectoral patch of cinnamon that is usually wanting in *P. eremicus*.

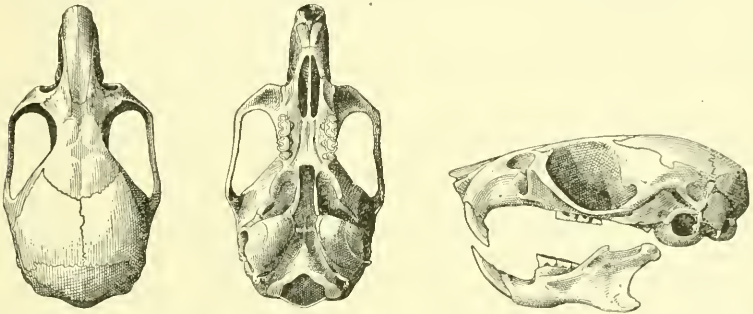

FIG. 105.—PEROMYSCUS MERRIAMI. SKULL. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

Cranial characters.—The skull (fig. 105) resembles that of *P. eremicus*, except that it is much larger and heavier, with the rostral portion relatively longer, the zygomatic arches wider anteriorly, and the brain case more elevated. Its larger size serves to identify the skull of this species at a glance, the two anterior molar teeth about equaling the lateral tooth-row of *P. eremicus*. In *P. eremicus* from Yuma the skull measures 25.2 mm. in length, *P. merriami* measuring 27 mm. In *P. merriami* the zygomatic arches stand out more prominently and are more nearly parallel to the long cranial axis, because the zygomatic processes are more produced and angular anteriorly. The profile of the skull is flatter than in the other desert mice. Compared with typical *P. eremicus*, the teeth are larger (fig. 106), with the cusps and corresponding enamel folds of the worn grinding surfaces more complex. The skull is of the *eremicus* type, having the nasals truncate posteriorly and ending well in advance of the nasal branches of the premaxillaries.

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[a] Ten specimens of *Peromyscus merriami* were taken at Sonoyta and one at Quitobaquita. Large series of *P. eremicus* were taken at the same places.

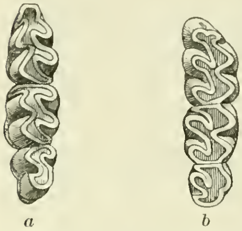

Fig. 106.—Peromyscus merriami. Crowns of molar teeth. *a*, lower series; *b*, upper series.

Local Distribution.—The Sonoyta desert mouse was fairly common at Sonoyta, Sonora, and was found on the north side of the boundary, in Pima County, Arizona, as well as in Mexico. Fields and brush fences were its habitat. In the flesh it was very evidently distinct from *Peromyscus eremicus*, which is abundant in the same region.

Measurements of 9 specimens of Peromyscus merriami.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hindfoot and claw.	Ear from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
59249	59249	2775	Sonoyta, Sonora, Mexico, near Monument No. 168.	Jan. 12	[a] ♂ ad.	......	......	22.0	16.5
59254	59254	2776	.....do	....do...	[b] ♀ ad.	211	114	22	16.5
59241	59241	2802	.....do	Jan. 20	♂ ad.	218	118	22.7	19
59237	59237	2807	.....do	Jan. 21	♀ ad.	197	102	22.4	17.3
59242	59242	2808	.....do	....do...	♀ juv.	193	102	22	16
59234	59234	2815	.....do	....do...	♀ ad.	217	113	23	20
59235	59235	2816	.....do	Jan. 22	♂ im.	194	104	22.8	17
59244	59244	2824	.....do	Jan. 23	♂ juv.	208	111	23	19
59781	59781	2868	Quitobaquita, Pima County, Arizona.	Jan. 31	[c] ♀ ad.	......	......	22	17

[a] Head and body, 97.

[b] Contained two large fetuses.

[c] Head and body, 95. Contained three fetuses.

PEROMYSCUS TIBURONENSIS Mearns.

TIBURON ISLAND DESERT MOUSE.

Peromyscus tiburonensis Mearns, Proc. U. S. Nat. Mus., XIX, 1897, pp. 720, 721 (original description).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., No. 1, XXX, Dec. 27, 1901, p. 87 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Peromyscus*] *tiburonensis*, Elliot, Field Col. Mus., Zool. Ser., IV, 1904, p. 175 (Mam. Mid. Am.).

Type-locality.—Tiburon Island, Gulf of California, Mexico. (Type, skin and skull, No. 63186, U. S. National Museum.)

Geographical range.—An insular form, known only from the type locality (Tiburon Island).

Description.—Smallest of the desert mice. Length of hind foot, 19 mm.; ear from notch, 16. Skull, 24 by 12. Color above, drab gray, thickly mixed with black; sides ochraceous cinnamon; under surfaces and feet white; ears purplish black, almost naked; tail quite densely coated with blackish hairs.

Cranial and dental characters.—Compared with *Peromyscus eremicus* (Baird), its skull (fig. 107) is smaller, broad interorbitally, higher posteriorly, narrower and more depressed anteriorly. The audital bullæ are much less developed, and the incisive foramina and interpterygoid fossa wider. The teeth (fig. 108) are considerably smaller.

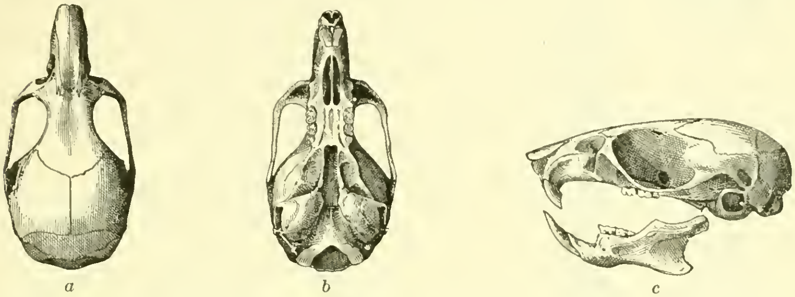

FIG. 107.—PEROMYSCUS TIBURONENSIS. SKULL. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

Remarks.—This species was taken on Tiburon Island by Mr. J. W. Mitchell, who accompanied Doctor McGee, of the Bureau of Ethnology, on his exploration in the region inhabited by the Seri Indians during the season of 1895–96. Though occurring beyond the scope embraced by the present report, the species is here introduced for the purpose of completing the history of the desert mice that are closely related to *Peromyscus eremicus.* This insular form was evidently derived from *P. eremicus* of the adjacent mainland, from which it differs in being smaller, with a darker coloration, more hairy tail, and in having certain cranial peculiarities, described above.

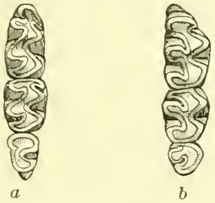

FIG. 108.—PEROMYSCUS TIBURONENSIS. CROWNS OF MOLAR TEETH. *a*, LOWER SERIES; *b*, UPPER SERIES.

Genus SIGMODON Say and Ord (1825).

Sigmodon SAY and ORD, Journ. Acad. Nat. Sci. Phila., IV, Pt. 2, 1825, p. 352.

Dentition.—I. $\frac{1-1}{1-1}$; M. $\frac{3-3}{3-3} = 16$.

Type.—*Sigmodon hispidus* Say and Ord.

Characters.—Form ratlike, with prominent ears and a somewhat hairy tail (fig. 109). Grinding teeth, with crowns flattened and divided into S-shaped loops formed by plates of hard enamel inclosing a softer substance (dentine); skull with a prominent supraorbital fronto-parietal ridge.

Remarks.—Two species occur on the Mexican Border: One (*Sigmodon hispidus*) ranges west from the Atlantic and Gulf coasts to the western waters of the Colorado Basin, but does not reach the Pacific Coast Tract, though its range crosses four differentiation tracts, and it has become differentiated into a corresponding number of excellent subspecies. The other species (*S. minimus*) is restricted to the Elevated Central Tract, which separates the two desert tracts and is known only from the boundary strip.

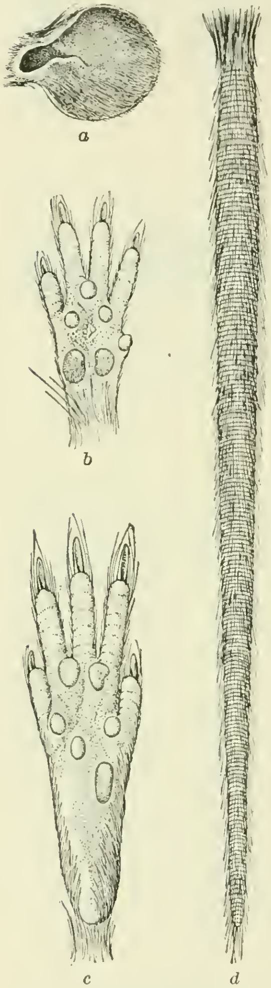

FIG. 109.—SIGMODON HISPIDUS ARIZONÆ. *a*, EAR; *b*, FOREFOOT; *c*, HINDFOOT; *d*, TAIL.

SIGMODON MINIMUS Mearns.

MEARNS COTTON-RAT.

Sigmodon minimus MEARNS, Proc. U. S. Nat. Mus., XVII, pp. 129, 130, July 19, 1894 (original description). ALLEN, Bull. Am. Mus. Nat. Hist., VII, 1895, pp. 220, 221.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 91 (Syst. Results Study N. Am. Mam. to close of 1900); XXXI, Aug. 27, 1903, p. 81 (Syst. Results Study N. Am. Mam. during the years 1901 and 1902).—BAILEY, Proc. Biol. Soc. Washington, XV, p. 114, June 2, 1902 (Synopsis of the North American species of Sigmodon).

[*Sigmodon*] *minimus*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 146 (Synop. Mam. N. Am.); IV, 1904, p. 230 (Mam. Mid. Am.).

Type-locality.—Grassy hollows and flats between the most southern spurs of the Apache Mountains, near Monument No. 40, at an altitude of 1,500 meters. (Type, skin and skull, Cat. No. $\frac{21187}{37291}$, U. S. National Museum.)

Geographical range.—Elevated Central Tract, along the Mexican Boundary, from Monument No. 40 west to Monument No. 111 in the Upper Sonoran Life Zone.

Description.—Size, small; length, 240 mm.; tail, 100; ear, 14; hind foot, 28; coat, bushy and hispid; under fur, dark plumbeous; coarse outer coat quite bristly, especially on the sides of the head and neck; ears, feet, and tail densely hairy, the latter not distinctly bicolor; color of upper surface, grayish, the individual hairs being ringed with gray and brown, the brown annuli being blackish in their middle portion, fading to light-yellowish brown on their edges; under surface of body clayey buff; feet yellowish gray; ears densely clothed with grayish hairs on inner surface, with their convex surface black anteriorly and buff posteriorly; tail brownish black, somewhat lighter below, the hairs almost concealing the annuli.

Cranial characters.—The skull (fig. 110), compared with skulls of *Sigmodon hispidus* and its races, is short and high, with the rostral portion shortened and the nasals more contracted apically. Correlated with the greater height of the brain case is the much deeper temporal fossa, which is divided by an approximately median longitudinal osseous ridge into two nearly equal areas, the lower giving rise to that portion of the temporalis muscle which is inserted into the outer surface and posterior margin of the coronoid process of the mandible, the upper to that which is inserted in the anterior border and inner surface of the coronoid. In *Sigmodon minimus* these two parts of the temporalis muscle are of approximately equal size, while in *S. hispidus* the two are very unequal, the lower being much smaller than the upper.

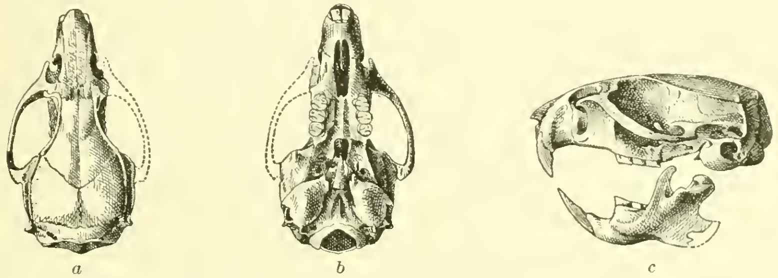

FIG. 110.—SIGMODON MINIMUS. SKULL. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

General remarks.—The original description of this species, written in the field, was based on two skins and three skulls, together with several fragments, all from the type-locality. At the present time thirteen additional skins from localities farther west, beyond the San Luis Mountains, are before me. These, allowing for season, are darker in color and somewhat larger. Dr. J. A. Allen has given the measurements of two adult males, taken at San Bernardino Ranch (Monument No. 77), by Mr. B. C. Condit, and these agree very closely with the dimensions of our specimens from the Santa Cruz Valley, near Monument No. 111. As the type of *Sigmodon minimus* was obtained at the western edge of the Eastern Desert, it is possible, should its range be found to extend into the center of that tract, that the larger and darker central form may require separation as a geographical race, with the Elevated Central Tract for its habitat. The typical form in that case would be restricted to the Eastern Desert Tract. For comparison with the type and topotypes of *Sigmodon minimus*, two adults, male and female, taken at Igo's Ranch, at the northern base of the Huachuca Mountains, Arizona,[a] are selected, for the reason that they were taken at nearly the same season of the year, the type having been taken in April and these specimens in March, both being in faded winter pelage. The coloration of the Arizona specimens is much darker. The upper surface is composed of a mixture of plumbeous, black, gray, and ferruginous colors, the underfur being plumbeous black and the overhair black, banded with brown and rusty white, giving a coarsely grizzled aspect. Under surface tawny ochraceous buff. Feet rusty grayish white. Ears black on the anterior portion of the convex surface; residue of ear with the hairs tipped with rusty white. Tail brownish black, darkest above. Nine specimens from the Santa Cruz Valley, taken during November, are in fresh pelage and darker, with less rusty than those taken in early spring. For measurements see p. 452

Habits and local distribution.—This hairy-tailed cotton-rat lives in open, grassy country and is both nocturnal and diurnal. During excessively dry seasons many of them perish.

SIGMODON HISPIDUS TEXIANUS (Audubon and Bachman).

TEXAS COTTON-RAT.

Arvicola texiana AUDUBON and BACHMAN, Quad. N. Am., III, 1853, p. 229, pl. CXLVII, fig. 2 (original figure and description).

Sigmodon hispidus texianus, ALLEN, Bull. Am. Mus. Nat. Hist., VI, 1894, p. 175.—BAILEY, Proc. Biol. Soc. Washington, XV, p. 105, June 2, 1902 (part).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 91 (Syst. Results Study N. Am. Mam. to close of 1900); XXXI, Aug. 27, 1903, p. 80 (Syst. Results Study N. Am. Mam. during the years 1901 and 1902).

Sigmodon hispidus berlandieri ALLEN, Bull. Am. Mus. Nat. Hist., II, 1889, p. 180 (in text); III, 1890, p. 186 (in part); p. 224 (in part; as to Texas specimens).

[*Sigmodon hispidus*] *texensis* ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 144 (Synop. Mam. N. Am.).

Sigmodon hispidus berlandieri, BAILEY, Proc. Biol. Soc. Washington, XV, p. 106 June 2, 1902 (in part; as to specimens from Fort Clark and other portions of the Middle Texan Tract).

Type-locality.—"This was first discovered on the river Brazos and afterwards seen in the country along the Nueces and Rio Grande, where chapparal thickets afford it shelter."

Geographical range.—Southern Texas, east of the desert.

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[a] These specimens are referred to by Mr. W. W. Price in the Bulletin of the American Museum of Natural History, New York (VII, 1895, p. 221), as follows: "A cotton-rat, probably of this species [*i. e.*, *Sigmodon hispidus arizonæ* Mearns], is found at Igo's ranch, at the north end of the Huachuca Mountains. It was said to be common in a moist garden plot. However, I had no opportunity of visiting the place." Mr. Price collected a small series of *S. hispidus arizonæ* at Fairbank, on the San Pedro River, only a few miles from Igo's ranch, and naturally supposed the cotton-rats of the two places to be of the same species. It is interesting to find these two species living practically together here and also in the Yaqui River valley.

Description.—Externally this species may be readily distinguished from the preceding (*Sigmodon minimus*) by its grayish-white undersurface, the finer grizzle of its upper surface, its less blackish tail, and considerably larger size. The skull of *minimus* may be immediately recognized by the characters pointed out above. Specimens of *Sigmodon hispidus texianus*, taken at Fort Clark, Kinney County, Texas, near the upper Nueces River, may be regarded as typical of this form. They are a little paler than those from Brownsville, near the mouth of the Rio Grande. The upper surface is yellowish brown, finely mixed with black and dull grayish. The coloration is quite uniform, though there is less black on the sides than above. Undersurface grayish white, the long white overhair permitting the gray underfur to show between them. The underfur is plumbeous above, much paler than in *S. minimus*. Tail brownish black on upper longitudinal third, dirty grayish elsewhere, duller above as the coat fades. The feet are grayish white. Length, 250 mm.; tail, 100; ear from crown, 12.5; hind foot, 32. Skull, 32 by 19 mm.[a]

Remarks.—Dr. J. A. Allen[b] has clearly shown the validity of the subspecific characters of the Texas cotton-rat, and has also shown that it is the animal described as *Arvicola texiana* by Audubon and Bachman.

SIGMODON HISPIDUS BERLANDIERI (Baird).

EASTERN DESERT COTTON-RAT.

Sigmodon berlandieri Baird, Proc. Acad. Nat. Sci. Philadelphia, VII, 1855, p. 333; Mam. N. Am., 1857, p. 504 (part); Rep. U. S. Mex Bound. Surv., II, Pt. 2, Mam., p. 46 (part).

Sigmodon hispidus pallidus Mearns, Proc. U. S. Nat. Mus., XX, 1898, p. 405 (advance sheet issued Mar. 5, 1897).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 90 (Syst. Results Study N. Am. Mam. to close of 1900).

Sigmodon hispidus berlandieri, Bailey, Proc. Biol. Soc. Washington, XV, p. 106, June 2, 1902 (in part) (Synopsis of the North American Species of Sigmodon).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXXI, Aug. 27, 1903, p. 80 (Syst. Results Study N. Am. Mam. during the years 1901 and 1902).

[*Sigmodon hispidus*] *pallidus*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 145 (Synop. Mam. N. Am.).

[*Sigmodon*] *hispidus berlandieri*, Elliot, Field Col. Mus., Zool. Ser., IV, 1904, p. 227 (Mam. Mid. Am.).

Type-locality.—Left bank of the Rio Grande, opposite the initial Monument (No 1), and about six miles above El Paso, Texas. (Type, skin and skull, Cat. No. $\frac{566}{1687}$, U. S. National Museum.)

Geographical range.—Inhabits the edge of streams flowing through the ancient lake basins of the upper Rio Grande, in the Eastern Desert Tract.

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[a] See also p. 452.

[b] Bull. Am. Mus. Nat. Hist., II, 1889, p. 175.

Description.—This race is much smaller, paler, and grayer than *Sigmodon hispidus texianus* or *S. h. arizonæ*, and lacks their brown color, which is replaced by gray. Above soiled grayish, finely mixed with black. Below pure white. Tail quite hairy, with the median upper surface dusky. Ear much larger, actually as well as relatively, than that of *S. h. texianus*. Length, 242 mm.; tail vertebræ, 103; ear from crown, 14; hind foot, 30. Skull (about) 30 by 18 mm. (See also p. 453). The teeth are shown in fig. 111.

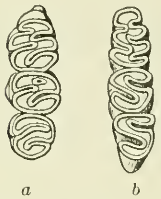

Fig. 111.—Sigmodon hispidus berlandieri. Crown of molar teeth. *a*, upper series; *b*, lower series.

Comparisons.—This, the smallest of the four geographical races of *Sigmodon hispidus* found on the Mexican line, differs from the almost equally pallid form of the Western Desert (*Sigmodon hispidus eremicus*) in being of a grayish instead of a yellowish color, and in lacking the terminal expansion of the nasals. The cotton-rat of the Elevated Central Tract (*S. h. arizonæ*) is so much larger and darker than either of the desert forms (*berlandieri* and *eremicus*) that further comparison is unnecessary.

SIGMODON HISPIDUS ARIZONÆ Mearns.

ARIZONA COTTON-RAT.

Sigmodon hispidus arizonæ Mearns, Bull. Am. Mus. Nat. Hist., II, p. 287, Feb. 21, 1890 (original description).—Allen, Bull. Am. Mus. Nat. Hist., III, 1891, p. 208 (in text); V, 1893, p. 28 (" One specimen from Granados [on the Yaqui River], Nov. 16"); VII, 1895, p. 220 (critical remarks on a dozen specimens taken at Fairbank, on the San Pedro River, Arizona).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 90 (Syst. Results Study N. Am. Mam. to close of 1900); XXXI, Aug. 27, 1903, p. 80 (Syst. Results Study N. Am. Mam. during the years 1901 and 1902).—Bailey, Proc. Biol. Soc. Washington, XV, p. 108, June 2, 1902 (Synopsis of the North American Species of Sigmodon).

[*Sigmodon hispidus*] *arizonæ*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 144 (Synop. Mam. N. Am.).

[*Sigmodon*] *hispidus arizonæ*, Elliot, Field Col. Mus., Zool. Ser., IV, 1904, p. 228 (Mam. Mid. Am.).

Kähl'-lä of the Hopi Indians.

Tu'-sa or *Ah-mé-lä* of the Hualapai Indians.

Type-locality.—Alfalfa fields on the Verde River at Fort Verde, Yavapai County, Arizona. (Type, skin and skull, Cat. No. $\frac{1841}{2370}$, American Museum of Natural History.)

Geographical range.—Inhabits the Elevated Central Tract from Fort Verde, Arizona, to Granados, in Sonora, Mexico.

Description.—Size large. Coloration darker than that of the desert forms (*pallidus* and *eremicus*) on either side of its range, but paler than in the coast forms (*hispidus, littoralis, texianus*, etc.). Above light yellowish brown, mixed with ashy, lined rather sparingly with black; below white; pelage everywhere plumbeous at base; tail dusky above, whitish below. Ears large, orbicular, clothed with bushy, yellowish brown hairs on both surfaces, more sparingly outside. Pelage coarser and more hispid than that of any other form of this species on the Mexican Line. Length, 320 mm.; tail vertebræ, 120; ear from crown, 18; hind foot, 36. Skull, 46 by 22 mm. in greatest dimensions. (See also p. 453.) The skull is high at the interorbital region, sloping down in either direction; nasal bones compressed apically. The dentition is very heavy. (Fig. 112.)

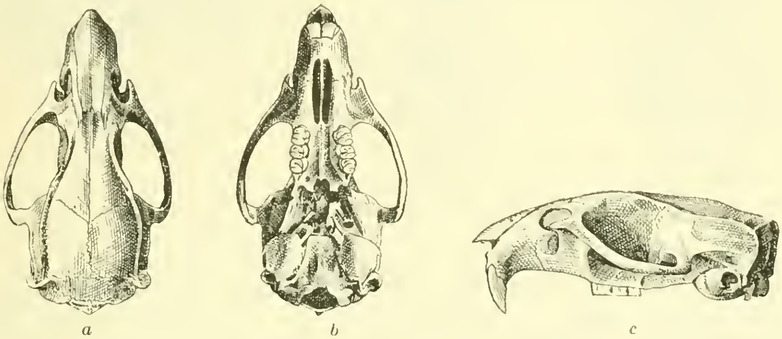

FIG. 112.—SIGMODON HISPIDUS ARIZONÆ. SKULL OF TYPE. *a*. DORSAL VIEW; *b*, VENTRAL VIEW; *c* LATERAL VIEW.

Remarks.—This is much the largest representative of the genus *Sigmodon* found within the United States. It is known only from the Verde River, in central Arizona; from the San Pedro River, at Fairbank, in southern Arizona; and from Granados, on the Yaqui River, in Sonora, Mexico.

SIGMODON HISPIDUS EREMICUS Mearns.

WESTERN DESERT COTTON-RAT.

Sigmodon hispidus eremicus MEARNS, Proc. U. S. Nat. Mus., XX, 1898, p. 504 (advance sheet issued Mar. 5, 1897; original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 90 (Syst. Results Study N. Am. Mam. to close of 1900); XXXI, Aug. 27, 1903 (Syst. Results Study N. Am. Mam. during the years 1901 and 1902).—BAILEY, Proc. Biol. Soc. Washington, XV, p. 107, June 2, 1902 (Synopsis of the North American Species of Sigmodon).

[*Sigmodon hispidus*] *eremicus*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 145 (Synop. Mam. N. Am).

[*Sigmodon*] *hispidus eremicus*, ELLIOT, Field Col. Mus., Zool. Ser., IV, 1904, p. 227 (Mam. Mid. Am.).

Type-locality.—Colorado River bottom, 30 miles below Monument No. 204, in Sonora, Mexico. (Type, skin and skull, Cat. No. 60319, U. S. National Museum.)

Geographical range.—Inhabits marshes, alfalfa fields, and brushy ground in the vicinity of streams in the Western Desert Tract.

Description.—Size medium. Coloration pallid and yellowish. Upper surface yellow-brown mixed with gray and darker brown; sides and rump tinged with ochraceous. Under surface white, the gray undercoat appearing between the hairs. Feet grayish white. Tail scantily haired, not distinctly dusky above. Iris hazel. Length, 275 mm.; tail vertebræ, 130; ear from crown, 15; hind foot, 33. Skull, 20 by 35 mm. in greatest dimensions.[a] Nasal bones slightly expanded apically so as to produce a somewhat spatulate extremity. (Fig. 113.)

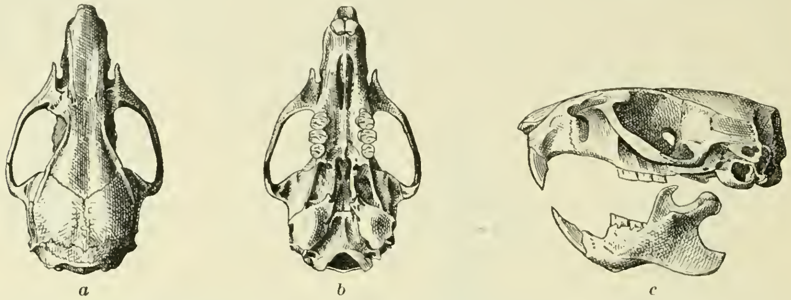

FIG. 113.—SIGMODON HISPIDUS EREMICUS. SKULL OF TYPE. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

Habits and local distribution.—The Western Desert cotton-rat was found in abundance on both sides of the Colorado River from Yuma to the Gulf of California. It was most numerous about beds of wild hemp which grow luxuriantly upon the broad savannas bordering the Colorado about the mouth of the tributary called the Hardy River or Hardys Colorado. On the Colorado Desert, where it lives in dense growths of arrowwood, this species extends along the Salton River as far as Seven Wells, in Lower California, becoming gradually scarce as the stream recedes from the Colorado River. Four females, taken March 24 and 25, 1894, would have given birth to four young each.

Measurements of 48 specimens of the genus Sigmodon.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Ear from crown.	Length of hind-foot.
Skin.	Skull.								
			Sigmodon minimus.	1892.		*mm.*	*mm.*	*mm.*	*mm.*
21187	37291	1704	Monument No. 40	Apr. 26	[b] ♂ ad.	223	94	14.0	28.0
21190	37290	1760	....do	May 13	♂ ad.	223	91	12.0	27.0
20612	35772	765	La Noria, Santa Cruz River, near Monument No. 111.	Nov. 8	♀ ad.	233	72	15.5	31.5
20613	35773	766	....do	....do	♂ im.	212	96	13.0	27.5
20648	35927	787	....do	....do	♂.	119	91	15.5	30.0
20641	......	798	....do	Nov. 12	♂.	......	110	......	29.5
20647	35788	802	....do	Nov. 13	♂ ad.	244	100	15.0	28.5
20724	35869	849	....do	Nov. 28	♂ ad.	240	98	14.0	28.0
20723	35891	855	....do	....do	♂ im.	195	88	13.0	26.0
			Sigmodon hispidus texianus.	1893.					
21188	37293	2192	Fort Clark, Kinney County, Texas.	Jan. 12	♀ ad.	248	103	14.0	31.5
12701[c]	10995	2231	....do	Jan. 17	♀ ad.	254	102	13.0	32.0
83305	83305	2269	....do	Feb. 5	♂ ad.	246	95	12.5	31.5

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[a] See also p. 453.

[b] Type.

[c] American Museum of Natural History.

Measurements of 48 specimens of the genus Sigmodon—Continued.

Museum number. Skin.	Museum number. Skull.	Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail to end of vertebræ.	Ear from crown.	Length of hind-foot.
			Sigmodon hispidus berlandieri.	1892.		*mm.*	*mm.*	*mm.*	*mm.*
20103	35464	1461	Initial Monument No. 1, on the Rio Grande, near El Paso.	Feb. 19	[a] ♂ ad.	242	103	14.0	30.0
			Sigmodon hispidus arizonæ.	1885.					
2370[b]	1841	242	Fort Verde, Yavapai County, Arizona.	Sept. 18	[c] ♂ ad.	320	116	18.0	36.0
2371[b]	([d])	243	.....do	....do ...	♂.	308	129	15.0	35.0
2372[b]	1843	253	.....do	Oct. 2	♂ juv.	270	116	17.0	36.0
				1886.					
2373[b]	1842	455	.....do	Sept. 3	♀ ad.	313	145	19.0	37.0
			Sigmodon hispidus eremicus.	1894.					
60293	60293	3135	Colorado River at Monument No. 204.	Mar. 15	♂ ad.	287	134	15.0	33.0
60294	60294	3136	.....do	....do ...	♀ ad.	241	111	14.0	32.0
60290	60290	3137	.....do	....do ...	♂ juv.	216	98	14.5	28.0
60303	60303	3186	.....do	Mar. 17	♂ im.	236	108	16.0	32.0
60291	60291	3230	.....do	Mar. 19	♀ juv.	215	100	13.5	30.0
60300	60300	3240	.....do	Mar. 20	♂ juv.	194	77	13.3	29.0
60295	60295	3269	.....do	Mar. 22	♀ ad.	271	121	14.0	33.5
60292	60292	3282	.....do	Mar. 26	♀ im.	223	106	15.0	31.0
60297	60297	3333	Colorado River at Monument No. 205.	Mar. 28	♂ im.	224	107	15.0	30.0
60298	60298	3334	.....do	....do ...	♂ ad.	245	114	16.0	33.0
60296	60296	3335	.....do	....do ...	♀ ad.	248	115	16.5	32.0
60299	60299	3336	.....do	....do ...	♀ ad.	247	114	15.0	33.0
60305	60305	3346	.....do	Mar. 30	♀ juv.	210	96	16.0	30.0
60304	60304	3347	.....do	....do ...	♀ ad.	233	111	16.0	31.0
60301	60301	3348	.....do	....do ...	♂ ad.	229	108	16.5	32.0
60318	60318	3365	Well at Cienega, 30 miles south of Monument No. 204.	Mar. 24	♀ ad.	271	121	15.0	32.0
60317	60317	3366	.....do	....do ...	♂ ad.	263	112	15.0	33.0
60319	60319	3367	... do	...do ...	[c] ♂ ad.	280	128	15.0	34.0
60310	60310	3389	Colorado River, Sonora, opposite mouth of Hardy River.	Mar. 25	♀ ad.	252	109	15.0	31.0
60312	60312	3390	.....do	....do ...	♀ ad.	268	115	15.0	33.0
60313	60313	3391	.....do	....do ...	♀ ad.	253	109	15.0	32.0
60306	60306	3400	.....do	....do ...	[e] ♂ ad.	......	......	15.5	32.0
60315	60315	3410	.....do	Mar. 26	♀ ad.	240	106	14.0	31.0
60307	60307	3416	.....do	Mar. 27	♀ ad.	244	108	14.8	32.0
60309	60309	3417	.....do	....do ...	♀ juv.	217	102	......	......
60308	60308	3418	.....do	....do ...	♀ ad.	238	108	14.8	31.0
60314	60314	3431	.....do	Mar .28	♀ ad.	276	130	15.0	32.0
60316	60316	3432	.....do	....do ...	♂ ad.	254	126	15.0	32.0
60311	60311	3433	.....do	....do ...	[f] ♀ ad.	......	......	15.5	31.0
60320	60320	3482	Fort Yuma, San Diego County, California.	Apr. 3	[g] ♂ ad.	......	......	14.5	32.0
8249[b]	6592	1157	Seven Wells, Salton River, Sonora.	Apr 17	♀ ad.	252	120	15.0	33.0

[a] Type of *pallidus*.
[b] American Museum of Natural History.
[c] Type.
[d] In skin.
[e] Head and body 130 mm.
[f] Head and body 150 mm.
[g] Head and body 163 mm.

Genus ORYZOMYS Baird (1857).

Oryzomys Baird, Mam. N. Am., 1857, p. 458.

Dentition.—I. $\frac{1-1}{1-1}$; M. $\frac{3-3}{3-3}=16$.

Type.—*Mus palustris* Harlan.

Characters.—Body slender; tail long, scaly, and somewhat hairy; fore foot with two large oval palmar and three small rounded digital tubercles; hind foot with four large rounded digital tubercles and two plantar tubercles, a small rounded one near the outer side and a large elongate one near the inner margin posteriorly; belly not white; incisors without grooves; molars with tubercles arranged in two longitudinal rows; skull strongly ridged above the orbits.

Remarks.—Two species of *Oryzomys*, *O. palustris texensis* Allen and *O. aquaticus* Allen, have been described from Texas. We did not meet with them.

ORYZOMYS PALUSTRIS TEXENSIS Allen.[a]

TEXAS RICEFIELD MOUSE.

Oryzomys palustris texensis Allen, Bull. Am. Mus. Nat. Hist., VI, p. 177, May 31, 1894 (original description).—Merriam, Proc. Washington Acad. Sci., III, p. 276, July 26, 1901 (synonymy and footnote).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 94 (Syst. Results Study N. Am. Mam. to close of 1900); XXXI, p. 84.

[*Oryzomys palustris*] *texensis*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 147 (Synop. Mam. N. Am.).

Type-locality.—Rockport, Aransas County, Texas.

Geographical range.—Southeastern Texas, in the lower Austral Zone.

Description.—The original description reads as follows:

> Above very pale yellowish gray-brown, varied with blackish over the middle of the dorsal region, forming an indistinct blackish dorsal band; sides yellowish gray, very slightly varied with blackish tipped hairs. Below clear grayish white, the fur plumbeous at base.
>
> Total length (of type, No. $\frac{7166}{5764}$, ♂ ad., Rockport, Texas, Nov. 15, 1893, H. P. Attwater), 277 mm.; head and body, 137; tail vertebræ, 140; hind foot, 30.5.
>
> Seven adult males give the following, based on collector's measurements taken from fresh specimens: Total length, 249 to 280, averaging 264; head and body, 122 to 146, averaging 131; tail vertebræ, 122 to 140, averaging 132; hind foot, 28.5 to 30.5, averaging 30.
>
> This is simply a large pallid form of the *O. palustris* group. The Rockport series, when compared with Louisiana and Florida specimens of *O. palustris natator* Chapm.,[b] is strikingly different in coloration, about as different, and differing much in the same way, as the Brown Rat (*Mus decumanus*) and the muskrat. The color differences are much less when the Rockport series is compared with North Carolina specimens (true *O. palustris*), but are still very appreciable, while the size is much larger.

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[a] Doctor Merriam observes (Proc. Washington Academy of Sciences, III, p. 276, July 26, 1901): "I am unable to distinguish Allen's subspecies *texensis*, either externally or by the skulls, from *O. palustris* from Raleigh, North Carolina, and Dismal Swamp, Virginia. The brain case may average a trifle narrower, but the difference is very slight." Doctor Allen still regards the form as a recognizable subspecies.

[b] See Bull. Am. Mus. Nat. Hist., V, p. 44, Mar. 17, 1893.

The following comparative measurements indicate the average size of the three forms (measurements in millimeters):

Form.	Number of specimens.	Locality.	Total length.	Tail.	Hind-foot.
O. palustris [a]	5 ′	Raleigh, North Carolina	237	120	30
O. p. natator [a]	5 ′	Gainesville, Florida	286	136	33
O. p. texensis	7 ′	Rockport, Texas	264	132	30

[a] Cf. Chapman, idem., p. 44.

This is doubtless the large pale form mentioned by Doctor Coues (Mon. N. Am. Roden. 1877, p. 116) as occurring at Neosho Falls, Kansas. All of the *Oryzomys* thus far examined from Brownsville, Texas, have proved to be *O. aquaticus*—a very different species from any form of the *O. palustris* group. On the other hand, Corpus Christi Chapman, l. c., p. 45) and Rockport specimens have all proved referable to what is here termed *O. p. texensis.*

The Rockport series numbers 29 specimens, and includes young of various ages, middle-aged specimens, and eight or ten that are fully adult. Two were taken in March, one in January, and the rest between October 4 and December 5. One (No. 65, Coll. H. P. Attwater) is exceptionally rufescent. This is the single example mentioned by Mr. Chapman (l. c., p. 45) as apparently referable to his *O. p. natator.* (Bull. Am. Mus. Nat. Hist., VI, 1894, p. 276.)

The Texas form is probably subspecifically distinct from *Oryzomys palustris.* I have recently compared a series of topotypes of *palustris* from New Jersey with series from Virginia and South Carolina, the latter practically topotypes of *Arvicola oryzivora* Bachman (=*Oryzomys palustris oryzivorus*, Rhoads)[a], and find the northern form to be distinguishable from the others by its smaller ears (almost as small as those of *natator* from Florida), more grizzled pelage above and below, slightly shorter tail, and more robust skull. If not the subspecies *texensis*, the Ricefield mouse of Texas must be called *Oryzomys palustris oryzivorus* (Bachman).

ORYZOMYS AQUATICUS Allen.

ALLEN RICEFIELD MOUSE.

Oryzomys aquaticus Allen, Bull. Am. Mus. Nat. Hist., III, p. 289, June 30, 1891 (original description).—Merriam, Proc. Washington Acad. Sci., III, p. 277, July 26, 1901 (Synopsis of the Rice Rats [genus Oryzomys] of the United States and Mexico).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 92 (Syst. Results Study N. Am. Mam. to close of 1900).—Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 146, fig. 32 (skull and teeth).

Type-locality.—Brownsville, Cameron County, Texas.

Geographical range.—Subtropical zone, in the Tamaulipan Tract, southeastern Texas.

Description.—Size large: tail long; upper parts yellowish brown; under parts buff; tail brown above, yellowish below. Total length, 290 mm.; tail vertebræ, 150; hind foot, 33. Skull massive, high inter-

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[a] American Naturalist, XXXVI, No. 428, August, 1902, p. 662.

orbitally, with a heavy supraorbital ridge extending to the occiput; occipito-nasal length, 36 mm.; zygomatic breadth, 20; tooth-row, 5. This species may be instantly distinguished from *texensis* by its yellowish instead of grayish belly, and its generally yellower coloration and larger size.

Genus REITHRODONTOMYS Giglioli (1873).

Mus, AUDUBON and BACHMAN, Journ. Acad. Nat. Sci. Phila., VIII, 1842, p. 307.

Hesperomys, WAGNER, Wiegm. Arch., 1843 (2), p. 51.

Reithrodon, LE CONTE, Proc. Acad. Nat. Sci. Phila., 1853, pp. 410, 413.—BAIRD, Mam. N. Am., 1857, p. 447 (not of Waterhouse).

Reithrodontomys GIGLIOLI, Ricer. intorn. alla distrib. geog. gener., 1873, p. 60.

Ochetodon COUES, Proc. Acad. Nat. Sci. Phila., 1874, p. 184.

Description.—Externally similar to *Peromyscus*. Size small. Tail usually long and scantily coated with hair (fig. 115*c*). Feet as shown in fig. 115*a*, *b*. The molar teeth (fig. 115 *d* to *g*) resemble those of *Peromyscus*, but the upper incisors differ in being strongly grooved (fig. 115*h*, *i*).

Seven forms of this genus inhabit the region contiguous to the Mexican Boundary Line. Five of these occur commonly on the line; one in Sonora, 150 miles south of the line, and one in the Chiricahua Mountains, Arizona, about 25 miles north of it. These forms may be considered as belonging to two groups, one of which contains three long-tailed, reddish forms of the so-called *mexicanus* group (*Reithrodontomys mexicanus*, *R. laceyi*, and *R. fulvescens*), the other four more-grayish, short-tailed forms of the *megalotis* group (*R. megalotis*, *R. megalotis deserti*, *R. arizonensis*, and *R. longicauda*). Dr. J. A. Allen, in a recent paper on the genus *Reithrodontomys*,[a] considered the four forms of the *megalotis* group as constituting three species (*R. megalotis*, *R. arizonensis*, and *R. longicauda*), and one subspecies (*R. megalotis deserti*). I have followed him in this for the reasons that I have seen no specimens of *R. arizonensis*,[b] or of intergrades between *R. megalotis deserti* and *R. longicauda*, though I strongly suspect that the form from southern California, recognized by Doctor Allen under the name of *Reithrodontomys longicauda pallidus* (Rhoads), actually represents, in part, intergrades between *R. longicauda* and *R. m. deserti*, the remaining specimens tabulated being true *R. longicauda* (especially those from the Coast Range Mountains, Jacumba, Nachoguero Valley, Cameron's Ranch, San Isidro, Jamul Creek, Dulzura, and Santa Isabel) and *R. m. deserti* (as those collected by Mr. Holzner, at Seven Wells and Gardner's Laguna certainly are). In fact, while it is certain that Mr. Rhoads described as *Reithrodontomys pallidus* a specimen from Santa Isabel, California, which is indistinguishable from topotypes of Baird's *Reithrodontomys longicauda*, his *R. pallidus* thus becoming a complete synonym of *R. longicauda*, it is equally plain that Allen's *pallidus* is thoroughly composite, his table of 157 specimens embracing series of true *longicauda* and typical *deserti*, which I myself examined and measured in the field, from several localities on the Colorado Desert and the Pacific slope, west of the Coast Range, as well as specimens from the San Bernardino Valley and other localities, which perhaps represented intergrades between the form of the interior desert region (*R. m. deserti*) and that of the Pacific Coast strip (*R. longicauda*). I regard it as probable that the four forms of the *R. megalotis* group, named above, will eventually be proved to be conspecific, in which case the latter three (*arizonensis*, *deserti*, and *longicauda*) will have to stand as subspecies of *Reithrodontomys megalotis* (Baird), which was the first one named.

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[a] Bull. Am. Mus. Nat. Hist., VII, pp. 107–143, May 21, 1895.

[b] It is possible that this represents a connecting form between the *mexicanus* and *megalotis* groups.

The several forms of this genus known from the region of the Boundary may, perhaps, be identified by reference to the following

KEY TO REITHRODONTOMYS FOUND ON THE MEXICAN BOUNDARY.

a. Total length more than 150 mm.

b. Total length less than 170 mm. Above yellowish brown mixed with black, but without a darker vertebral area; sides faintly fulvous. *Reithrodontomys laceyi* (p. 458).

bb. Total length more than 170 mm.

c. Length, 178 mm.; tail vertebræ, 99; ear, 12. Above grayish brown with a yellowish wash; sides strong yellowish fulvous; below dull whitish. *Reithrodontomys mexicanus intermedius* (p. 457).

cc. Length, 172 mm; tail vertebræ, 99; ear, 14. Above pale yellowish brown, lined with black, with a blackish median area; sides light yellowish; below white. *Reithrodontomys fulvescens* (p. 459).

aa. Total length less than 150 mm.

d. Coloration pale, above yellowish gray, lined with darker, and more fulvous on sides.

e. Tail one-half the total length; color above yellowish gray, considerably mixed with blackish; pelage full and soft...... *Reithrodontomys megalotis* (p. 460).

ee. Tail more than half the total length; color above yellowish, but little mixed with darker; pelage short and somewhat harsh. *Reithrodontomys megalotis deserti* (p. 462).

dd. Coloration dark; above yellowish brown, lined with blackish, with a darker median dorsal area.

f. Length, 118 mm.; tail vertebræ, 77; hind foot, 17. Top of head grayish brown.......................... *Reithrodontomys longicauda* (p. 464).

ff. Length, 149; tail vertebræ, 78; hind foot, 17. Top of head reddish brown. *Reithrodontomys arizonensis* (p. 459).

REITHRODONTOMYS MEXICANUS INTERMEDIUS Allen.

TAMAULIPAS HARVEST-MOUSE.

Reithrodontomys mexicanus intermedius Allen, Bull. Am. Mus. Nat. Hist., VII, p. 136, May 21, 1895 (original description); VIII, 1896, p. 236 (in text).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 99 (Syst. Results Study N. Am. Mam. to close of 1900).

Ochetodon mexicanus, ALLEN, Bull. Am. Mus. Nat. Hist., III, p. 223, Apr. 29, 1891, (Bee County, Texas; Santa Teresa, Tamaulipas).—THOMAS, Proc. Zool. Soc. Lond., 1888, p. 447 (Duval County, Texas).

[*Reithrodontomys*] (*mexicanus*) *intermedius*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 153 (Synop. Mam. N. Am.).

R[*eithrodontomys*] *m*[*exicanus*] *intermedius*, ELLIOT, Field Col. Mus., Zool. Ser., IV, 1904, pp. 257 and 264 (Mam. Mid. Am.).

Type-locality.—Brownsville, Texas. (Type, skin and skull, in the American Museum of Natural History, New York.)

Geographical distribution.—Tropical zone of northeastern Mexico and adjacent part of Texas, extending up the Gulf coast as far as Corpus Christi. In the interior of Texas, represented by *Reithrodontomys laceyi* Allen.

The following is the original description:

Description.—Similar in size and proportions to *R. mexicanus*, but very much paler.

Adult.—Above grayish brown, washed with pale yellowish, varied slightly with darker hairs over the median area of the back, lighter on the sides, and becoming more yellow along the lateral line. Below white, the hairs plumbeous at base and broadly tipped with white. Ears brown, darker toward the margin on the outer surface, thinly haired, the very short hairs on the apical third of the inner surface rufous. Feet soiled white. Tail dusky, nearly unicolor (the lower surface a little lighter than the upper), nearly naked, the annuli nearly always conspicuously visible.

Young.—Paler and more nearly uniform above, with less of the pale fulvous wash; beneath with less white to the tips of the hairs; the dusky earmark more conspicuous.

Measurements.—Type, ♀ ad.: Length, 194; tail vertebræ, 108; hind foot, 21; ear (from skin), 13; ratio of tail vertebræ to total length, 54.6

Fifteen specimens from Brownsville, Texas, measure: Length, 178 (160–198); tail vertebræ, 98.7 (90–110); hind foot, 20 (19–21); ear (from skin), 12 (11–13); ratio of tail vertebræ to total length, 55.5 (53–58.5). (Bull. Am. Mus. Nat. Hist., VII, 1895, p. 136.)

REITHRODONTOMYS LACEYI Allen.

LACEY HARVEST-MOUSE.

Reithrodontomys laceyi ALLEN, Bull. Am. Mus. Nat. Hist., VIII, p. 235, Nov. 21, 1896 (original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec., 27, 1901, p. 97 (Syst. Results Study N. Am. Mam. to the close of 1900).

Reithrodontomys mexicanus intermedius ALLEN, Bull. Am. Mus. Nat. Hist., VII, p. 136, May 21, 1895, (in part); 1896, p. 66 (neighborhood of San Antonio, Texas).

[*Reithrodontomys*] *laceyi*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 153 (Synop. Mam. N. Am.).

Type-locality.—Watson's Ranch, 15 miles south of San Antonio, Texas. (Type, skin and skull, in the American Museum of Natural History, New York.)

Geographical range.—Lower Sonoran Zone of the Middle Texas Tract.

The following is the original description:

Description.—Above yellowish brown, strongly mixed with blackish, the black-tipped hairs increasing in abundance toward the median line without, however, forming a distinct dorsal area generally an indistinct fulvous lateral line, varying in distinctness according to the season. Below grayish white, the fur plumbeous at base and tipped broadly with whitish. Feet dull soiled white; ears large, thinly haired, brown externally, yellowish brown internally. Tail long, distinctly bicolor, the upper third dull brown, the rest soiled grayish white, covered with fine short hairs, which form a slight pencil at tip.

The young are darker with less fulvous.

In the new full coat the fulvous tint is stronger, the lateral line broader and brighter, and the lower surface whiter. In worn breeding pelage the tints are all paler.

Measurements.—Type specimen, ♂ ad.: total length, 156; tail vertebræ, 89; hind foot, 19; ear (from skin), 12.

	Length.	Tail vertebræ.	Hindfoot.
6 males	158 (112-165)	90 (84-100)	19 (18-19.5)
5 females	152 (140-156)	85(79-89)	18.5 (16?-19)

(Bull. Am. Mus. Nat. Hist., VIII, 1896, p. 235.)

REITHRODONTOMYS FULVESCENS Allen.

SONORAN HARVEST-MOUSE.

Reithrodontomys mexicanus fulvescens ALLEN, Bull. Am. Mus. Nat. Hist., VI, p. 319, Nov. 7, 1894 (original description).

Reithrodontomys fulvescens, ALLEN, Bull. Am. Mus. Nat. Hist., VII, p. 138, May 21, 1895, (10 miles south of Oposura, Sonora, Mexico); VII, Art. VI, June 29, 1895, p. 235.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 96 (Syst. Results Study N. Am. Mam. to close of 1900).

R[eithrodontomys] m[exicanus] fulvescens, ELLIOT, Field Col. Mus., Zool. Ser., IV, 1904, pp. 257 and 264 (Mam. Mid. Am.).

Type-locality.—Ten miles south of Oposura, Sonora, Mexico, in the valley of the Yaqui River. (Type, skin and skull, in the American Museum of Natural History, New York.)

Geographical range.—Basin of the Yaqui River, Sonora, Mexico. Lower Sonoran (and Tropical?) Zone.

The following is the original description:

Description.—Above yellowish brown, more or less heavily lined with black; a bright, strongly marked fulvous lateral line; below whitish, the basal two-thirds of the pelage plumbeous; ears dusky externally, rusty within, well clothed with fine short hairs; tail indistinctly bicolor, pale brown above, lighter below, sparsely haired, but the hairs pretty thoroughly concealing the annulations; feet soiled white, heels sparsely covered as far as the first tubercle with fine short hairs.

Measurements.—Total length (type), 183 mm.; tail vertebræ, 102; hind foot, 19; ear, 14. Average of three adults (2 males, 1 female): Total length, 172; tail vertebræ, 99; hind foot, 19.3; ear, 14.7. (Bull. Am. Mus. Nat. Hist., VI, 1894, p. 319.)

This [species] is represented by three adult specimens taken by Mr. B. C. Condit at Oposura, Sonora, May 31 and June 1, 1894.

REITHRODONTOMYS ARIZONENSIS Allen.

CHIRICAHUA MOUNTAIN HARVEST-MOUSE.

Reithrodontomys arizonensis ALLEN, Bull. Am. Mus. Nat. Hist., VII, p. 134, May 21, 1895 (original description); VII, p. 235, June 29, 1895 (Rock Creek, Chiricahua Mountains, altitude about 8,000 feet).—MILLER and REHN, Proc. Bost. Soc. Nat.

Hist., XXX, No. 1, Dec. 27, 1901, p. 96 (Syst. Results Study N. Am. Mam. to close of 1900).

Reithrodontomys longicauda, Allen, Bull. Am. Mus. Nat. Hist., VI, 1894, p. 320 (in text).

[*Reithrodontomys*] *arizonensis*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 153 (Synop. Mam. N. Am.).

Type-locality.—Rock Creek in the Chiricahua Mountains, Cochise County, Arizona (altitude, 8,000 feet). (Type, skin and skull, in the American Museum of Natural History, New York.)

Geographical range.—Known only from the type-locality.

The following is the original description:

> *Description.*—*Adult.*—Above brown, lined with black, and washed with reddish fulvous, including the whole top of the head; middle of back slightly darker than rest of the dorsal surface; fulvous of sides strongly golden, forming a prominent broad lateral line, extending from the cheeks to the tail. Below grayish white, the fur plumbeous at base, with a rust-colored patch on the breast. Ears blackish, particularly along the outer border above; feet soiled white; tail nearly naked, indistinctly bicolor, dusky on the dorsal surface, gray below.
>
> *Young.*—Grayish brown above, ashy plumbeous below. Tail sparsely haired, the hairs only partly concealing the annulations.
>
> *Measurements.*—Type: Length, 152; tail vertebræ, 78; hind foot, 18; ear, 13; ratio of tail vertebræ to total length, 51.3. Four adults measure: Length, 149 (145–152); tail vertebræ, 78 (74–80); hind foot 17 (16–18); ear, 13 (12.5–14).
>
> This species finds its nearest relative in *R. longicauda* of California, from which it differs n more reddish coloration, particularly on the head. In size it is also considerably above the average of *R. longicauda*. Geographically the two forms are widely separated, so far as known *R. longicauda* not being found east of the San Jacinto Mountains in southern California. (Bull. Am. Mus. Nat. Hist., VII, 1895, p. 134).

REITHRODONTOMYS MEGALOTIS (Baird).

BIG-EARED HARVEST-MOUSE.

Reithrodon megalotis Baird, Rep. Pacific Railroad Surv., VIII, 1857, p. 451, pl. LXXXIV, fig. 4 (skull); Rep. U. S. and Mex. Bound. Surv., II, Pt. 2, Mam., 1859, p. 43, pl. XLVII, fig. 4 (structural details); pl. LXX, fig. 6 (structural details). Between Janos, Chihuahua and San Luis Springs (= Lang's Ranch), Grant County, New Mexico.

Reithrodontomys megalotis, Allen, Bull. Am. Mus. Nat. Hist., VI, 1894, p. 320 (Fairbank, Arizona); VII, p. 234, June 29, 1895 (Fairbank and San Bernardino Ranch, Arizona); VII, p. 125, May 21, 1895 (monograph of Reithrodontomys).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 98 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Reithrodontomys*] *megalotis*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 151 (Synop. Mam. N. Am.); IV, 1904, p. 259, fig. "43" (skull), fig. "XLI" (animal). (Mam. Mid. Am.).

Type-locality.—Janos Plain, on wagon road between Janos, Chihuahua, and San Luis Springs (Monument No. 66), Grant County, New Mexico. (Type, skin and skull, Cat. No. $\frac{1039}{2281}$, U. S. National Museum.)

Geographical range.—Sonoran Zone of the Elevated Central Tract. Dr. J. A. Allen has recorded the capture of this harvest mouse at Silver City, New Mexico; at Fairbank, Fort Huachuca, and St. Thomas, Arizona, and at other places not far from the Mexican Line. Found it as far east as Monument No. 15.

Description.—Form stout. Average measurements of four adults (3 males and 1 female): Length, 141 mm.; tail vertebræ, 70.3; ear from crown, 11.7; length of hind foot, 17.2; skull (fig. 114), 21 by 11.2. Pelage long and soft; tail and ears rather hairy. Above yellowish gray, with the hairs ringed with darker, and broadly pointed with blackish in the median dorsal area; sides more fulvous; chest sometimes with a small rust-colored spot; feet, and under surface, white, the hairs gray at base; tail bicolored, drab above and white below; ears externally drab, mixed with a few reddish and hoary hairs, internally scantily coated with reddish hairs, which form a tuft at anterior base of ear; whiskers colorless, reaching to shoulders.

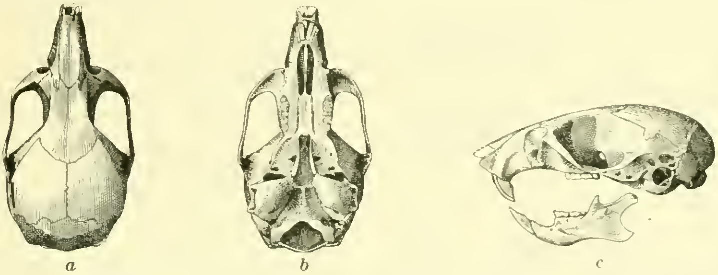

FIG. 114.—REITHRODONTOMYS MEGALOTIS. SKULL. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

Remarks.—The above description of this small mouse is based on four adults, taken near the type-locality, April 7 to 29, 1892. Typical *megalotis* was found by us at only two points: A single specimen was taken east of the Mimbres Valley, in New Mexico, near Monument No. 15, about 50 miles west of the initial Monument; and three were afterwards taken at the Upper Corner Monument, about 100 miles west of the Rio Grande, and almost due north of Janos—the place where the species was first discovered by Dr. C. B. Kennerly, of the old Mexican Survey, under Major Emory. We did not succeed in getting any more specimens of the genus *Reithrodontomys* until the survey party reached the Colorado River, whence it was abundant to the edge of the Pacific Ocean.

Measurement of 3 specimens of Reithrodontomys megalotis.

Museum numbers.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hindfoot and claw.	Ear from crown.
Skin.	Skull.								
				1892.		*mm.*	*mm.*	*mm.*	*mm.*
21365	37080	1650	Monument No. 15, about 50 miles west of El Paso.	Apr. 7	♂ ad.	137	72	17.0	11.5
21162	37081	1701	Monument No. 40, about 100 miles west of El Paso.	Apr. 26	♂ ad.	140	66	17.0	12.0
21163	37082	1702	....do........................	...do...	♀ ad.	145	73	18.5	11.5

REITHRODONTOMYS MEGALOTIS DESERTI Allen.

DESERT HARVEST-MOUSE.

Reithrodontomys megalotis deserti Allen, Bull. Am. Mus. Nat. Hist., VII, p. 127, May 21, 1895 (original description).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 98 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Reithrodontomys megalotis*] *pallidus*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 152 (part) (Synop. Mam. N. Am.).

[*Reithrodontomys longicaudus*] *pallidus*, Elliot, Field Col. Mus., Zool. Ser., IV, 1904, p. 622 (part) (Mam. Mid. Am.).

Type-locality.—Oasis Valley, Nye County, Nevada.

Geographical range.—From southern Nevada and Inyo County, California, south to the mouth of the Colorado River, Sonora, and Lower California.

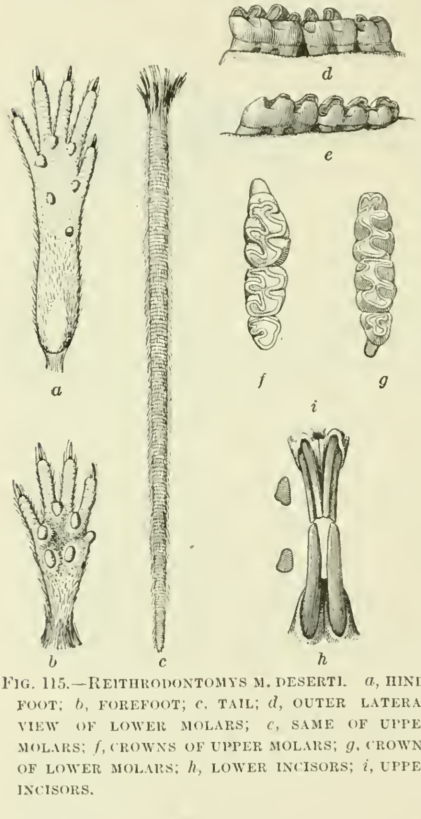

Fig. 115.—Reithrodontomys m. deserti. *a*, hind-foot; *b*, forefoot; *c*, tail; *d*, outer lateral view of lower molars; *c*, same of upper molars; *f*, crowns of upper molars; *g*, crowns of lower molars; *h*, lower incisors; *i*, upper incisors.

Description.—Slightly smaller than *R. megalotis*, with a longer tail; color paler; pelage, shorter and harsher. (Fig. 115.)

Measurements.—Average of 10 adult males: Total length, 140 mm.; tail vertebræ, 75; hind foot, 18; ear from crown, 11.35. Average of 10 adult females: Total length, 144 mm.; tail vertebræ, 75; hind foot, 17.7; ear from crown, 11.7.

Remarks.—Forty specimens taken along the Colorado River during March, 1894, exhibit but slight individual and age variations. Adults are all pure white below, excepting a few that have clay-colored pectoral patches. They vary some in the intensity of the yellowish color of the upper surface. Those that are immature are less yellowish than adults, and half-grown young are drab-gray above, grayish white below. A smaller series from Salton and New rivers, on the Colorado Desert, taken during April, closely resemble those from the Colorado, but are a shade paler and more grayish.

I am indebted to Dr. C. Hart Merriam for the opportunity of examining a large series of topotypes and the type of this subspecies from Oasis Valley, Nye County, Nevada. These differ from those taken by ourselves along the Colorado River, from Yuma to the Gulf of California, and thence westward across the Colorado Desert, in being of a paler, dusty, grayish color and in having more hairy tails, the hairs concealing the caudal annuli. Those from the Colorado River are almost as pale, but have a more yellowish coloring. An extreme specimen (Cat. No. 60157, U.S.N.M.), from the Colorado at Monument No. 204, is of a yellowish rust-color, almost exactly intermediate in coloration between the type of *R. megalotis deserti* and a specimen of the *R. mexicanus* group from Mazatlan, Mexico, and suggests an affinity between the *R. mexicanus* and *R. megalotis* groups.

Habits and local distribution.—In March, 1894, we found the desert harvest-mouse abundant along the Colorado River from Yuma to the Gulf of California. Its favorite home was amongst the dense growth of arrowwood that covers so large an extent of the Colorado bottom lands. On the Colorado Desert a few were taken at Seven Wells and Gardners Laguna, on the Salton River, in Lower California, in April, 1894. Females taken April 15 and 20, 1894, would have given birth to 4 young each.

Record and measurements of 39 specimens of Reithrodontomys megalotis deserti.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
60155	60155	3116	Monument No. 204, on bank of Colorado River.	Mar. 15	♀ ad.	121	65	17.0	10.5
60154	60154	3145	.....do	Mar. 16	♂ ad.	139	76	18.0	11.0
60145	60145	3187	.....do	Mar. 17	♀ im.	132	63	17.0	11.0
60156	60156	3276	.....do	Mar. 25	♂ ad.	131	71	17.0	11.0
60157	60157	3277	.....do	...do	♀ ad.	151	78	17.0	11.0
60148	60148	3295	Monument No. 205, on bank of Colorado River.	Mar. 26	♂ ad.	140	71	18.0	12.0
60149	60149	3296	.....do	...do	♀ juv.	116	60	16.0	11.0
60151	60151	3298	.....do	...do	♀	117	59	16.0	11.0
60150	60150	3299	.....do	...do	♀ juv.	127	66	17.0	10.0
60147	60147	3300	.....do	...do	♀	120	62	17.0	11.5
60132	60132	3315	.....do	Mar. 27	♀ ad.	128	68	17.0	11.5
60087	60087	3316	.....do	...do	♀	118	61	16.5	11.0
60088	60088	3317	.....do	...do	♂ ad.	146	80	19.0	12.0
60089	60089	3318	.....do	...do	♂	138	79	18.5	11.0
60131	60131	3319	.....do	...do	♂	131	73	17.0	11.0
60083	60083	3328	.....do	Mar. 28	♂ ad.	142	75	18.0	11.0
60085	60085	3329	.....do	...do	♂	136	71	18.0	10.5
60084	60084	3330	.....do	...do	♂	131	73	17.0	11.0
60086	60086	3331	.....do	...do	♂	128	65	17.0	11.5
61620	Alcoholic.	3850	.....do	Mar. 29	....	....	....	....	....
60140	60140	3351	.....do	Mar. 30	♂ ad.	144	71	18.0	12.0
60138	60138	3352	.....do	...do	♀ ad.	135	70	17.5	12.0
60137	60137	3353	.....do	...do	♂	124	65	17.0	10.5
60134	60134	3354	.....do	...do	♀ ad.	124	66	....	....
60139	60139	3355	.....do	...do	♀ im.	143	71	18.0	12.0
60141	60141	3356	.....do	...do	♂ ad.	126	69	16.5	10.5
60135	60135	3357	.....do	...do	♂	137	73	18.0	11.0
60133	60133	3358	.....do	...do	♀	119	61	17.0	11.0

Record and measurement of 39 specimens of Reithrodontomys megalotis deserti—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hindfoot and claw.	Ear from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
60162	60162	3373	Well at Cienega, 30 miles south of Monument No. 204, Sonora, Mexico.	Mar. 24	♀ ad.	147	74	17.5	12.0
60160	60160	3374	.....do	....do...	♂ ad.	145	76	17.5	12.0
60122	60122	3375	.....do	....do...	♂ im.	126	64	......	......
60161	60161	3376	.....do	....do...	♀ ad.	152	80	18.6	11.0
60171	60171	3477	Fort Yuma, San Diego County, California.	Apr. 2	♂	137	70	18.0	11.5
60825	60825	1136	Seven Wells, Lower California..	Apr. 15	♀ ad.	141	79	18.0	13.0
[a]8070	6427	1149	.....do	Apr. 16	♀ ad.	160	83	19.0	11.0
60826	60826	1150	.....do	Apr. 17	♂	135	72	18.5	11.5
[a]8073	6430	1158	Gardners Laguna, Colorado Desert, Lower California.	Apr. 19	♀ juv.	105	57	......	......
60827	60827	1162	.....do	Apr. 20	♀ ad.	146	79	17.0	12.5
[a]8067	6424	1177	.....do	Apr. 26	♀ im.	108	58	15.5	10.0

[a] In collection of American Museum of Natural History, New York.

REITHRODONTOMYS LONGICAUDA (Baird).

SONOMA HARVEST-MOUSE.

Reithrodon longicauda BAIRD, Mam. N. Am., 1857, p. 451 (original description).

Ochetodon longicauda, TRUE, Proc. U. S. Nat. Mus., VII, 1885, p. 598.

Reithrodontomys longicauda, ALLEN, Bull. Am. Mus. Nat. Hist., VII, p. 129, May 21, 1895.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Reithrodontomys*] *longicaudus*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 151 (Synop. Mam. N. Am.); IV, 1904, p. 261 (Mam. Mid. Am.).

Type-locality.—Petaluma, Sonoma County, California.

Geographical range.—Coast region of southern and Lower California, in the Austral and Transition zones.

Description.—Slightly smaller than *R. megalotis*, with relatively smaller ears and a longer tail. Mammæ, 3 pairs. Upper parts yellowish brown mixed with gray and with blackish rings and tips to the hairs, giving a dark color to the middle dorsal area; sides and rump more fulvous; under parts grayish white, some times washed with clay color and usually with a small fulvous area on the chest; tail rather scantily coated, dusky drab above, whitish below; ears externally hair-brown with a few reddish and grayish hairs intermixed, their concave surface scantily clothed with reddish hair. Quite young individuals are hair-brown above, grayish white below. The skull is shown in fig. 116.

Measurements.—Average of 20 adult males: Total length, 146 mm.; tail vertebræ, 77; hind foot, 17; ear from crown, 10.82. Average of 15 adult females: Total length, 148.5 mm.; tail vertebræ, 77.33; hind foot, 17; ear from crown, 10.9.

Remarks.—In the series of about 70 specimens before me from the Pacific section of the boundary strip (Mountain Spring to San Diego), but little variation in color is observed, though some are in late winter dress and others in summer pelage. In the latter the coat is shorter and a shade darker. They are quite uniform, however, and agree essentially with fresh topotypes of Baird's *R. longicauda* and Rhoads's *R. pallidus.* I have compared them with the type of *R. pallidus,* which is an immature example of *R. longicauda* Baird, and a little darker than any other specimen from California that I have seen.

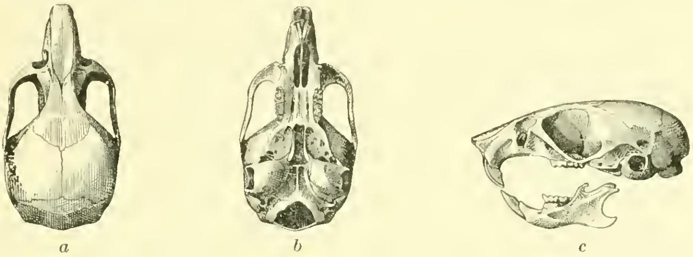

FIG. 116.—REITHRODONTOMYS LONGICAUDA. SKULL. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

The Sonoma harvest-mouse is abundant in damp localities of the Pacific Coast Tract. The young, numbering from 3 to 5 in a litter, are born during May and June.

Record and measurements of 60 specimens of Reithrodontomys longicauda.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hind foot and claw.	Ear from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
[a]3289	2568	......	Santa Isabel, California	....	[b]♀ ad.	137	73	17.0	......
61030	61030	3517	Mountain Spring, San Diego County, California.	May 14	[c]♀ ad.	149	78	16.0	10.5
[a]8079	6436	1236	.....do	....do...	♂ ad.	150	80	16.7	10.0
60816	60816	1248	.....do	May 15	♂ juv.	......	......	......	......
61035	61035	3534	Jacumba, San Diego County, California, near Monument No. 233.	May 18	♀ ad.	155	84	17.0	10.0
61039	61039	3543	.....do	May 19	♂ ad.	148	79	17.5	12.0
61041	61041	3553	.....do	May 21	♂ ad.	145	76	17.0	9.7
61042	61042	3554	.....do	....do...	[d]♀ ad.	142	73	17.0	10.5
61016	61016	3574	.....do	May 24	♂ ad.	142	73	17.0	10.0
[a]8089	6445	1286	.....do	May 19	♀ ad.	147	75	17.0	12.0
60817	60817	1311	.....do	May 22	♂ ad.	149	79	17.0	10.7
[a]8103	(?)	1327	.....do	May 24	[e]♀ ad.	133	64	16.0	9.5
60818	60818	1122	Nachoguero Valley, Lower California.	June 8	♂ ad.	154	78	17.5	10.0
60819	60819	1424	.....do	June 9	[f]♀ ad.	147	73	17.0	10.3
61060	61060	3631	Campo, San Diego County, California, near Monument No. 240.	June 8	♂ ad.	146	77	17.0	11.0

[a] In collection of American Museum of Natural History, New York.

[b] Type of *pallidus* Rhoads.

[c] Contained 3 fetuses.

[d] Mammæ P. $\frac{1}{1}$, A. $\frac{0}{0}$, I. $\frac{2}{2}=3$ pairs.

[e] Contained 4 fetuses.

[f] Contained 5 fetuses.

Record and measurements of 60 specimens of Reithrodontomys longicauda—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Total length.	Tail vertebræ.	Hindfoot and claw.	Ear from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
[a]8131	6482	1496	Cameron's Ranch, San Diego County, California.	June 22	♀ ad.	144	72	16.0	10.0
60820	60820	1497	.....do	....do...	♂ juv.	125	63	16.0	10.0
[a]8137	6487	1520	San Isidro Ranch, Lower California, near Monument No. 250.	June 29	♂ ad.	145	76	17.0	10.5
61075	61075	1530	.....do	June 30	♂ ad.	144	75	17.0	10.0
[a]8141	6491	1531	.....do	....do...	♂ ad.	140	74	16.5	10.0
[a]8145	6494	1560	.....do	July 3	♂ ad.	135	70	17.0	10.0
61079	61079	3703	.....do	June 29	[b] ♀ ad.	150	75	17.0	12.0
61665	Alcoholic.	3725	.....do	June 30	♀ ad.	160	86	18.0	12.0
61676	Alcoholic.	3753	.....do	July 2	♀ juv.	......	......	......	......
61091	....	3760	El Nido, Jamul Creek, San Diego County, California.	July 4	♂ ad.	141	73	17.5	10.0
61096	61096	3768	.....do	July 6	♂ ad.	147	77	16.5	10.5
61099	61099	3777	.....do	July 8	♂ ad.	144	74	16.5	11.8
60821	60821	1564	.....do	July 6	♂ ad.	139	74	16.5	10.5
[a]8147	6496	1565	.....do	....do...	[c] ♀ ad.	141	73	17.0	9.5
60822	60822	1566	.....do	....do...	♂ im.	131	68	16.8	9.7
[a]8148	6497	1567	.....do	....do...	♂ im.	127	67	16.0	10.0
60823	60823	1584	.....do	July 8	♂	......	......	......	......
[a]8151	6500	1585	.....do	....do...	♀ juv.	......	......	......	......
60824	60824	1586	.....do	....do...	♀ ad.	137	69	17.0	10.0
[a]8155	6503	1600	Pacific Ocean, at Monument No. 258.	July 14	♂ ad.	145	77	17.0	10.0
61104	61104	1601	.....do	....do...	♀ juv.	......	......	......	......
[a]8156	6504	1602	.....do	....do...	♂ ad.	146	75	16.5	10.3
61105	61105	1603	.....do	....do...	♂ ad.	141	73	17.0	11.0
[a]8157	6505	1604	.....do	....do...	♀ ad.	147	78	16.0	10.4
61103	61103	3790	.....do	July 13	♂ ad.	145	71	17.7	10.5
61677	Alcoholic.	3796	.....do	July 16	♀ juv.	......	......	......	......
				1895.					
......	....	1663	San Diego County, California...	Aug. 10	♀ ad.	136	74	17.0	12.0
......	....	1686	.....do	Aug. 12	♀ ad.	147	78	16.0	11.0
......	....	1689	.....do	....do...	♂ ad.	145	82	17.0	12.0
......	....	1690	.....do	....do...	♂ ad.	140	70	16.5	11.5
......	....	1687	.....do	....do...	♀ ad.	144	75	16.0	11.5
......	....	1703	.....do	Aug. 14	♀ ad.	145	76	17.0	11.5
......	....	1688	.....do	Aug. 12	♀ ad.	155	84	17.0	11.0
......	....	1691	.....do	....do...	♂ ad.	141	74	16.0	11.0
......	....	1677	.....do	Aug. 11	♂ ad.	150	81	16.5	11.5
......	....	1676	.....do	....do...	♂ ad.	148	78	17.0	11.0
......	....	1682	.....do	....do...	♂ ad.	146	78	18.0	12.0
......	....	1678	.....do	....do...	♂ ad.	141	77	16.5	11.0
......	....	1661	.....do	Aug. 10	♂ ad.	141	78	17.0	13.0
......	....	1681	.....do	Aug. 11	♀ ad.	154	80	17.0	11.0
......	....	1662	.....do	Aug. 10	♂ ad.	137	78	16.5	12.0
......	....	1704	.....do	Aug. 14	[d] ♂ ad.	......	......	......	......
......	....	1679	.....do	Aug. 11	♀ juv.	136	74	......	......
......	....	1880	.....do	....do...	♀ juv.	128	67	......	......
......	....	1685	.....do	Aug. 12	♀ juv.	......	......	......	......

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[a] In collection of American Museum of Natural History, New York.

[b] Contained 4 fetuses.

[c] Has nursed young.

[d] Head and body, 68 mm.

Subfamily NEOTOMINÆ.

WOOD-RATS.

Cranium not abruptly constricted in front of brain case, which is oval, gradually narrowing into orbit; orbital and temporal fossæ indistinguishable, without trace of separation; jugal wholly posterior, forming insignificant part of zygoma and never reaching forward halfway from squamosal root to maxillary plate; sagittal area elongated, at least twice as long as broad; angular process of mandible broadly expanded vertically, inflected, not hamular, and never thickened at end; infra-condylar notch high and shallow. * * *

Molars prismatic, rooted or semirooted; the crowns flat, their sides continuously invested with enamel which is folded on itself in such manner as to present on each side of the tooth a series of salient loops, alternating with reentrant angles or interspaces. (*Merriam.*)

Genus NEOTOMA Say and Ord (1825).

Neotoma SAY and ORD, Journ. Acad. Nat. Sci. Phila., VI, Pt. 2, 1825, pp. 345, 346, pls. XXI and XXII.

Type.—*Mus floridana* Ord, from eastern Florida.

Generic characters.[a]—Crown of m_3 composed of two transverse loops. (with the addition, in rare cases, of a narrow antero-external loop), never S-shaped; m_1 and $_2$ with middle loop undivided (reaching completely across tooth); molar series relatively short; condylar ramus low and directed obliquely backward; coronoid notch horizontal or nearly so [nearly vertical in *Xenomys* and *Hodomys*]; angle of mandible only moderately inflected; symphysis relatively short and sloping strongly forward. (*Merriam.*)

Subgenus **NEOTOMA** Say and Ord (1825).

Neotoma SAY and ORD, Journ. Acad. Nat. Sci. Phila., IV, Pt. 2, 1825, pp. 345, 346, pls. XXI, XXII.

Dentition.—I. $\frac{1-1}{1-1}$; M. $\frac{3-3}{3-3} = 16$.

Type.—*Mus floridana* Ord, from eastern Florida.

Tail commonly round, scant-haired, and tapering, but in one species moderately bushy; hind feet small or moderate.

Rostrum of moderate length, not more than one-third the length of cranium; sagittal area usually rounded, the broadest part always considerably anterior to plane of interparietal, whence the sides curve gradually backward to interparietal shield; spheno-palatine vacuities always open. (*Merriam.*)

None of the thirteen species and subspecies of *Neotoma* inhabiting the vicinity of the Mexican Line belong to the subgenus *Teonoma*,[a] proposed, in 1843, by J. E. Gray for the group of bushy-tailed wood rats.

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[a] The characters here given are selected with reference to antithesis with *Ptyssophorus*, *Hodomys*, and *Xenomys*.

KEY TO THE SPECIES AND SUBSPECIES OF NEOTOMA FOUND ON THE MEXICAN BOUNDARY.

a. Pelage of adult, gray.

b. Color slatish gray, dark. Length, 390 mm.; tail vertebræ, 180; hind foot, 40; ear, 25; skull, 48 by 25 . . . . . *Neotoma micropus* (p. 470).

bb. Color smoke gray, pallid. Length, 310 mm.; tail vertebræ, 125; hind foot, 36; ear, 22; skull, 43 by 24 . . . . . *Neotoma micropus canescens* (p. 471).

aa. Adult pelage fulvous or ochraceous, not gray.

c. Anterior loop of first upper molar completely divided by a deep sulcus; nasal and premaxillary bones ending evenly behind.

d. Size large. Length, 360 mm.; tail vertebræ, 160; hind foot, 37; ear, 25; skull, 47 by 24. Color dark fulvous . . . . . *Neotoma pinetorum* (p. 490).

dd. Size small. Length, 350 mm.; tail vertebræ, 175; hind foot, 35; ear, 20; skull, 44 by 21. Color paler and ochraceous.

e. Color pale, ochraceous, slightly darkened by black-tipped hairs; audital bullæ normal . . . . . *Neotoma mexicana* (p. 491).

ee. Color darker, clay-color, much darkened by black-tipped hairs; audital bullæ peculiar . . . . . *Neotoma mexicana bullata* (p. 491).

cc. Anterior loop of first upper molar without, or incompletely divided by, a sulcus; nasal bones ending in advance of the premaxillaries posteriorly.

f. Tail not bicolor; hind feet dusky . . . . . *Neotoma fuscipes macrotis* (p. 488).

ff. Tail bicolor; hind feet all white (except the heel in *N. attwateri*).

g. Skull of adult more than 45 mm. in length; upper molar series very much broader anteriorly than posteriorly; frontals abruptly expanded behind the interorbital constriction.

h. Nasal bones enlarged and spatulate anteriorly; hind foot all white *Neotoma cumulator* (p. 472).

hh. Nasal bones without an anterior spatulate enlargement; hind foot with the heel plumbeous . . . . . *Neotoma floridana attwateri* (p. 469).

gg. Skull of adult 45 mm. or less in length; upper molar series of more nearly equal breadth throughout; frontals never abruptly expanded behind the interorbital construction, but gradually increasing in width from before backward.

i. Audital bullæ enormously inflated; pelage silky; length, 300; tail vertebræ, 125; hind foot, 30; ear, 27 . *Neotoma desertorum* (p. 487).

ii. Audital bullæ moderately inflated; pelage coarser; size larger, but ears smaller.

j. Coloration dark; skull broad.

k. Color above, dark olivaceous-gray, lined with blackish *Neotoma intermedia* (p. 484).

kk. Color above, dark ochraceous-gray . *Neotoma albigula* (p. 476).

jj. Coloration pallid; skull narrow.

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[a] The subgenus *Teonoma* was revived by Merriam in 1894 and characterized as follows:

Tail very large, bushy, and somewhat distichous, like a squirrel's; hind feet very large. Rostrum much elongated, measuring more than one-third the total length of cranium; posterior roots of zygomata widely spreading; sagittal area long, narrow, and sharply angular, its broadest part far back, on or nearly on plane of anterior border of interparietal, whence the sides bend abruptly back to interparietal shields; phenopalatine vacuities closed or open.

l. Color pale grayish buff....*Neotoma intermedia gilva* (p. 486).
ll. Color pale cinereous gray
Neotoma albigula angusticeps (p. 482).
jjj. Coloration pallid; skull broad........*Neotoma venusta* (p. 475).

NEOTOMA FLORIDANA ATTWATERI (Mearns).

ATTWATER WOOD-RAT.

Neotoma attwateri MEARNS, Proc. U. S. Nat. Mus., XIX, pp. 721, July 30, 1897 (original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. I, Dec. 27, 1901, p. 101 (Syst. Results Study N. Am. Mam. to close of 1900).

Neotoma mexicana, ALLEN, Bull. Am. Mus. Nat. Hist., VIII, p. 60, Apr. 22, 1896.

[*Neotoma floridana*] *attwateri*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p 157 (Synop. Mam. N. Am.).

Type-locality.—Lacey's Ranch, on Turtle Creek, Kerr County, Texas. (Type, skin and skull, in the American Museum of Natural History, New York.)

Geographical range.—Known only from the Sonoran Zone of middle Texas.

Description.—Size, large. Length, 387 mm.; tail vertebræ, 178; hind foot, 39.4. Skull, 52 by 27. The ears are small, like those of *Neotoma floridana.* Tail well covered with hair. Pelage, in winter, long, dense, and soft. Upper surface of body ochraceous buff, mixed with grayish above and strongly lined with black; sides clearer ochraceous buff. Outer surface of limbs light gray. Under surfaces creamy white. Feet all white but the heel, which is light plumbeous. Whiskers black or colorless, and very long (80 mm.). Upper side of head smoke gray. The under pelage is dark plumbeous on the upper and white on the lower side of the body. The tail, which is sharply bicolored, is mouse gray above and white below.

Half-grown young are smoke gray above, drab gray on the sides and white below; upper side of tail, mouse gray.

Cranial and dental characters.—The skull is similar in shape, and in its dental characters, to that of *Neotoma floridana*, from which it differs only in being rather high in the frontal region, with the zygomatic arches more prominent posteriorly. The five skulls examined have a prominent crest on the basioccipital bone, which is absent in *N. floridana.* The rostral portion of the skull is as long as that of *N. floridana*, the nasal bones measuring 20 mm. in length. The teeth agree closely with those of *N. floridana.*

Remarks.—This species, which is named in honor of Mr. H. P. Attwater, the well-known field naturalist of San Antonio, Texas, was found by him associated with the Texas wood-rat (*Neotoma micropus* Baird), from which it differs so materially as to require no comparison. In coloration it resembles *N. leucodon* of Merriam, from farther south, in San Luis Potosi, Mexico; but is less reddish, and has smaller ears than that species. Compared with *N. leucodon*, its skull exhibits important differences in the size and shape of the post-palatal notch, in the teeth, and in the much greater length of the nasal bones and rostrum. Comparison with the members of the *Neotoma floridana* group from the neighboring States—Louisiana, Mississippi, Indian Territory, and Kansas—shows it to be a closely related form. The skull, including the teeth, agrees almost exactly with *N. floridana*. Externally it differs only in having a softer and finer coat, a much more hairy tail, and a paler and grayer coloration. Members of the *floridana* group have been described from Nebraska and Kansas, under the names *Neotoma baileyi* Merriam[a] and *N. campestris* Allen.[b] From these, *N. attwateri* differs in several minor cranial characters, as well as in the color and texture of the furry coat. It is not improbable, however, that all of these forms may prove to be but geographic races of *N. floridana*.

NEOTOMA MICROPUS Baird.

TEXAS WOOD RAT; SMALL-FOOTED WOOD-RAT.

Neotoma micropus Baird, Proc. Acad. Nat. Sci. Phila., Apr., 1855, p. 333 (original description; from Charco Escondido, Tamaulipas, Mexico).—Allen, Bull. Am. Mus. Nat. Hist., III, 1891, pp. 224, 282 (San Fernando de Presas, Tamaulipas); III, June 30, 1891, p. 282 (species reinstated); VI, May 31, 1894, p. 175 (Aransas County, Texas); VI, Aug. 3, 1894, p. 233, pl. IV (an important paper on "cranial variation in *Neotoma micropus* due to growth and individual differentiation"); VIII, Apr. 22, 1896, p. 60 (Bexar County, Texas).—Merriam, Proc. Acad. Nat. Sci. Phila., 1894, p. 244 (in part; unites the subspecies *canescens* with the typical form).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 107 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Neotoma*] *micropus*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 155 (Synop. Mam. N. Am.); IV, 1904, p. 281, fig. "XLIII" (Mam. Mid. Am.).

Type-locality.—Charco Escondido, Tamaulipas, Mexico, 62 miles west of Matamoras and 27 miles south of Reynosa. (Type, skull, Cat. No. 1676—skin missing—, U. S. National Museum.)

Geographical range.—Inhabits the Texan and Tamaulipan tracts of Mexico and the United States, ranging up the Rio Grande to the mouth of the Devils River. It occupies the lower Sonoran Zone.

Description.—Size, large; length, 390 mm.; tail vertebræ, 180; hind foot, 40; ear from crown, 25 (measurements of an adult male from Brownsville, Texas); skull, 48 by 25; color, "slatish gray" above; feet and under surface of head, body, and tail, white; tail, blackish above; ears, rather small and scantily clothed with a grayish pubescence, except on the anterior border of the convex surface, where the hair is longer and blackish.

Cranial characters.—The skull of this species of *Neotoma* resembles those of *Neotoma leucodon* and *N. cumulator*. The orbital margin is prominent, almost forming a bead, as in *Sigmodon*. The frontal bone is expanded and depressed postorbitally. The nasals end in advance of the intermaxillaries, and the upper molar series narrows rapidly from before backward and has the anterior loop of the first molar undivided by a sulcus, much as in *N. intermedia*. The cranial variations in this species, due to growth and individual differentiation, have been treated of in a special paper[a] by Dr. J. A. Allen, who had at his command a splendid amount of material for the purpose and has furnished mammalogists with very important data to aid them in making their comparisons of other species of this and other genera.

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[a] Proc. Biol. Soc. Wash., IX, p. 123, July 2, 1894.

[b] Bull. Am. Mus. Nat. Hist., VI, p. 322, Nov. 7, 1894.

Remarks.—Specimens of this species from Fort Clark, Kinney County, Texas, are rather paler in color and not quite so large as those from Brownsville, Texas, though they are distinctly referable to the typical form, which is replaced in the Eastern Desert Tract by the subspecies *canescens*.

Habits and local distribution.—The home of the Texas wood-rat is in the woods of Texas, usually near water. A female taken at Fort Clark, Texas, January 13, 1893, would have produced three young. Nests of this rat are commonly built about the roots of decayed trees that are surrounded by thickets.

Measurements of 6 specimens of Neotoma micropus.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail vertebræ.	Length of hind-foot.	Ear, height from crown.
Skin.	Skull.								
				1892.		*mm.*	*mm.*	*mm.*	*mm.*
63085	63085	2182	Fort Clark, Kinney County, Texas.	Dec. 31	♂ ad.	375	160	40.0	22.0
				1893.					
*a*12697	10991	2190	.....do...............................	Jan. 10	♀ ad.	370	162	37.0	26.0
63086	63086	2210	.....do...............................	Jan. 13	♀ ad.	337	140	40.0	22.0
*a*12698	10992	2256	.....do...............................	Feb. 1	♀ ad.	383	163	40.0	23.0
63087	63087	2297	.....do...............................	Feb. 20	♂ ad.	365	163	39.0	22.0
*a*12699	10993	2300	.....do...............................	Feb. 25	♀ ad.	350	150	38.0	22.0

[a] American Museum of Natural History.

NEOTOMA MICROPUS CANESCENS Allen.

PALLID WOOD-RAT.

Neotoma micropus canescens ALLEN, Bull. Am. Mus. Nat. Hist., III, No. 2, June 30, 1891, p. 285 (original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 107 (Syst. Results Study N. Am. Mam. to the close of 1900).

Neotoma micropus, MERRIAM, Proc. Acad. Nat. Sci. Phila., 1894, p. 244 (in part).

[*Neotoma*] *micropus*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 155 (in part); IV, 1901, p. 281 (part).

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[a] Bull. Am. Mus. Nat. Hist., VI, 1891, pp. 233–246, pl. IV.

Type-locality.—North Beaver River, Pan Handle of Oklahoma, near the New Mexico line. (Type, skin and skull, in the American Museum of Natural History, New York.)

Geographical range.—Eastern Desert Tract. Taken on the Mexican Boundary, from Fort Hancock, Texas (on the Rio Grande), west to Monument No. 15, fifty miles west of the Rio Grande.

Description.—Smaller; length, 310 mm.; tail vertebræ, 125; hind foot, 36; ear from crown, 22; skull, 43 by 24; color, smoke gray, much paler than that of the typical *micropus*, which is "slatish gray," as described by Baird.

Remarks.—I am indebted to Dr. J. A. Allen for the opportunity of examining his types of this race. The characters which he ascribes to it—small size and pallid coloration—are borne out by his series and strongly emphasized by the series from southwestern Texas and northwestern Chihuahua, collected by the International Boundary Commission. I consider it therefore to be an excellent subspecies well entitled to recognition.

Habits and local distribution.—The pallid wood-rat is usually found about streams and springs, often in the fringe of cottonwood and willow growth along rivers. A female taken at Fort Hancock on the Rio Grande contained three large young on June 24.

Measurements of 3 specimens of Neotoma micropus canescens.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail vertebræ.	Length of hind-foot.	Ear, height from crown.
Skin.	Skull.								
				1892.		*mm.*	*mm.*	*mm.*	*mm.*
20276	35551	1646	Monument No. 15, 50 miles west of the Rio Grande.	Apr. 6	♀ im.	275	107	34.0	19.0
21072	36110	2360	Fort Hancock, El Paso County, Texas.	1903. June 21	♀ ad.	308	122	36.0	22.0
21073	36111	2361	....do..............................	....do...	♀ ad.	307	127	36.0	19.0

NEOTOMA CUMULATOR Mearns.

COLORADO RIVER WOOD-RAT.

Neotoma cumulator Mearns, Proc. U. S. Nat. Mus., XX, 1897, p. 503 (advance sheet issued Mar. 5, 1897; original description).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 103 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Neotoma*] *cumulator*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 154 (Synop. Mam. N. Am.); IV, 1904, p. 280 (Mam. Mid. Am.).

Type-locality.—Old Fort Yuma, San Diego County, California. (Type, skin and skull, Cat. No. 60348, U. S. National Museum.)

Geographical range.—Inhabits the lower Sonoran Zone of the mesquite-wooded river bottoms from the lower Gila River to the mouth of the Colorado River.

General characters.—One of the largest of the round-tailed species (subgenus *Neotoma*), distinguished by its massive skull and teeth and peculiar cranial characters from all of the species of the surrounding region. The coloring is similar to that of *Neotoma intermedia*, being paler than the typical form and darker than the desert phase of that species (*Neotoma intermedia gilva*). The tail is more distinctly bicolored, nearly black above, and quite copiously coated with rather long hairs. It requires no close comparison with any of the neighboring forms, but is closely related to *N. leucodon*, described by Dr. C. H. Merriam, from San Luis Potosi, Mexico. Mammæ, 2 pairs.

Color.—Upper parts grayish fulvous, thickly mixed with black-tipped hairs, this color changing to gray on the legs and ochraceous buff on the sides. Tail rather long-haired, almost black above, and white below. Feet, a small patch at base of ear, and whole under surface of body, white. Ears scantily clothed with gray and black, downy hairs on concave surface, and on posterier two-thirds of convex surface; anterior third of convex surface covered with longer black hairs. Whiskers reaching to the shoulders; their color, mixed black and white. Usually with a dusky orbital area.

A young specimen (No. 60678, U.S.N.M.), no larger than *Onychomys torridus*, has a very silky coat, and is paler and more grayish than adults. The middle of the back is smoke-gray, the sides drab-gray, and the under parts white. The upper side of the tail is mouse-gray instead of black. The convex surfaces of the ears are black; but there is no dusky orbital area. This animal was found attached to the teat of its mother (No. 60677, U.S.N.M.), the latter dead in a trap.

Measurements.—Length, 400 mm.; tail vertebræ, 180; hind foot, 37; head, 55; ear, from crown, 28. Skull, 47.5 by 23.

Cranial characters.—The general shape of the skull in this species (fig. 117) is suggestive of that of *Neotoma leucodon* Merriam. It has the same prominent premaxillaries, ending posteriorly well behind the nasals. The skull, as a whole, is considerably lower and more convex antero-posteriorly than that of *N. leucodon;* and the brain-case is much more flat. The skull is more angular throughout, with the zygomatic arches standing out more squarely anteriorly. The interparietal bone has a less quadrate shape, being broader laterally, and more pointed posteriorly. The frontal is broader interorbitally, and lacks the prominent, almost beaded orbital rim. The nasals differ markedly in shape from those of *N. leucodon*, in having a prominent swelling of their anterior extremities, which gives them a distinctly spatulate form, in this respect agreeing with *Sigmodon hispidus eremicus*, inhabiting the same region. The rostral portion of the skull is thicker. The mandible is not so stout as it is in *N. leucodon,* and has a less pronounced angular process; but the most characteristic difference in the mandibles of the two species consists in the longer and more highly arched coronoid process of *N. leucodon,* the two species being comparable, in this regard, in extreme cases to the genera *Onychomys* and *Peromyscus.* The teeth are shown in fig. 118.

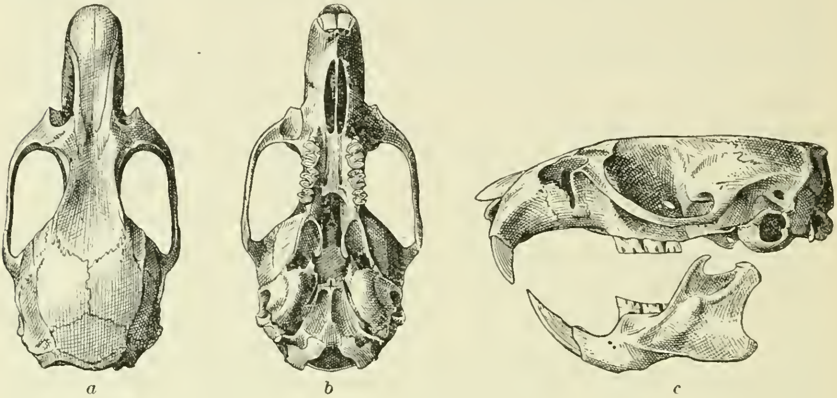

Fig. 117.—Neotoma cumulator. Skull of type. *a*, dorsal view; *b*, ventral view; *c*, lateral view.

Habits and local distribution.—This large wood-rat is found in abundance on both shores of the Colorado River from the Gila to the Gulf of California, and extends its range westward down the Salton and New rivers to points north of the Boundary Line in California. Its houses are usually built under the drooping branches of the large mesquites of this region, which commonly trail upon the ground, the lowest branches often being incorporated with the nest materials and affording convenient and well-worn avenues to the treetops. Most of these large, straggling trees show where wood-rats have gnawed away large sections of bark from the branches, leaving the white underlying wood exposed. The tallest branches are reached and denuded, producing an effect that can be seen from a great distance, as bands of white along the treetops. This rat also feeds upon the seeds of a gourd known by the name of "Coyote melon." The large round fruit of this gourd was usually seen among the heterogeneous materials piled up to form its enormous nests. More than fifty coyote melons were counted in one such heap, together with enough other materials to have filled a large wagon bed. From Yuma to Cooks Wells these dwellings were conspicuous under nearly every mesquite tree. We drove several rats out by setting fire to their mounds of débris. It is in this way that the

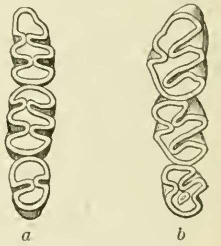

Fig. 118.—Neotoma cumulator. Crowns of molar teeth of type. *a*, lower series; *b*, upper series.

Indians usually capture this rat for food. About the shores of the Gulf of California I found wood-rats as far out upon the level savannas of that region as there were any mesquites. We obtained specimens as far west as Gardners Laguna, on the Salton River, Lower California. Mesquites were found all along Salton and New rivers, and west of them, at Indian Wells, and in canyons of the Coast Range; but the peculiar type of large spreading mesquite trees of the alluvial soil of the Colorado and Salton rivers does not extend much farther west than Cooks Wells, on the Salton River, and the specimens collected at Gardners Laguna perhaps mark the western limit of this species. Young were found at Seven Wells April 15, and a female taken at Gardners Laguna April 20 contained two small fetuses.

Measurements of 12 specimens of Neotoma eumulator.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail vertebræ.	Length of hind-foot.	Ear, height from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
60344	60344	3113	Colorado River at Monument No. 204.	Mar. 15	[a] ♀ ad.	......	.....	36.0	29.0
60347	60347	3114	.....do	....do...	♂ ad.	361	182	35.0	27.0
60342	60342	3115	.....do	....do...	♂ ad.	336	154	37.0	26.0
60343	60343	3185	.....do	Mar. 17	♀ ad.	362	175	37.0	22.0
60346	60346	3239	.....do	Mar. 20	♂ ad.	375	173	36.0	25.0
60345	60345	3286	.....do	Mar. 26	♂ ad.	376	178	35.0	25.0
60348	60348	3473	Old Fort Yuma, San Diego County, California.	Apr. 2	[b] ♂ ad.	403	188	37.0	25.0
60677	60677	1137	Seven Wells, Lower California, near Monument No. 213.	Apr. 15	♀ ad.	352	171	35.0	......
[c]8223	6567	1140	.....do	Apr. 16	♀ ad.	374	189	35.0	24.0
60679	60679	1163	Gardners Laguna, Lower California, near Monument No. 216.	Apr. 20	♀ ad.	360	178	35.0	25.0
60680	60680	1175	.....do	Apr. 25	♂ ad.	385	191	38.0	27.0
[c]8225	6569	1176	.....do	Apr. 26	♂ ad.	387	189	37.0	25.0

[a] Head and body, 185 mm.
[b] Type.
[c] American Museum of Natural History.

NEOTOMA VENUSTA True.

WESTERN DESERT WOOD-RAT.

Neotoma venusta True, Proc. U. S. Nat. Mus., XVII, p. 351; (advance sheet issued June 27, 1894; original description).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 109 (Syst. Results Study N. Am. Mam. to close of 1900).

Neotoma intermedia, Merriam, Proc. Acad. Nat. Sci. Phila., 1894, p. 247 (in part).

[*Neotoma intermedia*] *gilva*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 162 (in part) (Synop. Mam. N. Am.).

[*Neotoma*] *intermedia*, Elliot, Field Col. Mus., Zool. Ser., IV, 1904, p. 284 (in part).

Type-locality.—Carrizo Creek, Colorado Desert, San Diego County, California. (Type, skin and skull, Cat. No. $\frac{21696}{36400}$, U. S. National Museum.)

Geographical range.—Lower Sonoran Zone of the Colorado Desert.

Description.—"Size moderate. Ears large and thin. Tail as long as the head and body. Upper surfaces mingled buff and pale gray. Sides clearer buff, sharply marked off from the color of the under surfaces, which, together with the feet, are pure white. Hairs white to the base on the throat, sides of cheeks, breast, inside of fore legs, inguinal region, and feet. A tuft of pure white hairs at the base of the outer margin of the ears. Ears thinly clothed with long, whitish hairs. Tail gray above, pure white below. Skull thick and massive. Nasals shorter than the intermaxillæ and much contracted posteriorly. Interparietal large, with a convex posterior margin. Incisive foramina short and broad, reaching posteriorly about to the line of the molars. Tympanic bullæ large. Foramen magnum low and wide. Posterior termination of palate concave. Incisors very broad and convex. Molars long and broad." (*True.*)

Remarks.—This species is most closely related to *Neotoma cumulator*, from which it differs in having a softer and denser pelage and paler and more ashen color. The size is smaller. The type (No. $\frac{21696}{36400}$, U.S.N.M.) measured in the flesh by Mr. Frank Stephens, presented the following dimensions: Total length, 364 mm.; tail vertebræ, 173; hind foot, 35. The skull measured 44 by 24 mm. in its greatest diameters. Another specimen (No. $\frac{21697}{36401}$, U.S.N.M., from Buregas Spring, Colorado Desert, California), also collected by Mr. Stephens, measured: Total length, 366 mm.; tail vertebræ, 174; hind foot, 35. Skull 44.5 by 23.5. The skull differs from those of *N. cumulator* in the following particulars: The brain-case is broader and higher, which causes the supraorbital rims to diverge more rapidly; the premaxillaries are shorter, not extending far behind the nasal bones, which latter are less expanded apically; the palatal slits are shorter; the anteorbital foramen is wider; the audital bullæ are larger; and the teeth are smaller. *Neotoma venusta* is entirely distinct from *Neotoma intermedia gilva* inhabiting the same region.

NEOTOMA ALBIGULA Hartley.

WHITE-THROATED WOOD-RAT.

Neotoma albigula Hartley, Proc. Cal. Acad. Sci., 2d ser., III, pp. 157–159, pl. xii, May 9, 1894 (original description).

Neotoma intermedia albigula, Merriam, Proc. Acad. Nat. Sci. Phila., Sept. 24, 1894, p. 248.—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 105 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Neotoma intermedia*] *albigula*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 162 (Synop. Mam. N. Am.); IV, 1904, p. 285 (Mam. Mid. Am.).

Type-locality.—Vicinity of Fort Lowell, Arizona. (Type in the collection of the California Academy of Sciences.)

Geographical range.—Elevated Central Tract (Dog Spring to Sonoyta, Monuments Nos. 55 to 167, on the Mexican Boundary), north to the Colorado Plateau, south into Sonora and Chihuahua, Mexico.

Description.—A large, dark form separating the smaller pallid forms of the eastern and western deserts. Length, 330 mm.; tail vertebræ, 155; hind foot, 34; ear from crown, 25. Skull, 45 by 23. Above grayish yellow-brown, thickly lined with black; sides yellowish clay-color; head grayish, washed with ochraceous on cheeks; feet and under surfaces white; ears scantily coated with drab-colored hairs; tail grayish black above, white below; orbital region dusky grayish; whiskers long, black or colorless.

Cranial characters.—Skull relatively broader than in *Neotoma intermedia* and *N. i. gilva*. The wings of the sphenoid are further back than in the true *intermedia*.

Remarks.—This race is distinguished from the desert form *angusticeps* on the east by the absence of pallor; from the dark Pacific coast species *intermedia* it differs in being more yellowish brown, lacking the olivaceous-gray tone of the latter.

Habits and local distribution.—*Neotoma albigula* is the common wood-rat of the Austral and lower Transition zones, from the Colorado River to western Texas. East of the San Luis and Animas mountains it grades into the form of the Eastern Desert Tract which Dr. C. H. Merriam has distinguished as the subspecies *angusticeps*. The typical form lives in various situations, but is usually found in houses or mounds of rubbish that it heaps up by gathering together sticks, stones, cow-dung, bones, bits of glass, plants, seed-pods, and similar materials. The habit of accumulating is characteristic. In George Hance's cabin, Bloody Basin, Arizona, where I spent the night of April 19-20, 1888, these "trading" rats "packed" off some boxes of pills in the night; but Mr. Hance awoke me and I recovered my medicines after a chase. The rats were very bold in their forays notwithstanding the presence of a house-cat. I trapped two white-throated wood-rats in a closet of the quarters in which I lived, at Fort Verde, Arizona, and had the satisfaction of recovering from their nest a number of articles of household use that had been missed by us from time to time, the loss of which had occasioned us some inconvenience. Not until the young were half-grown was the nest discovered. On another occasion a wood-rat gnawed a hole in a pannier and destroyed a number of bird-skins. Hen's eggs were packed off to the rats' nests; and pill and powder boxes were frequently abstracted from the houses of my patients by this meddlesome and pilfering rat. Large quantities—the whole annual supply—of candles and soap (in cakes) were carried upstairs from the storeroom to the farthest corner of the garret of the post hospital at Fort Verde. At John Morris's ranch, on Clear Creek, near Fort Verde, in February, 1887, a pile of rubbish was burned on a large heap of rocks and stones gathered from a garden and potato field. The fire created an intense heat which destroyed most of the wood-rats that had selected this collection of rubbish for their home. Rats had been so numerous that six had been caught and killed in turning over this same heap of stones a few days earlier. Three days after the fire we again moved the stones and caught a rat that had its whiskers all singed off on one side. We also found a surprisingly large quantity of potatoes and Indian corn stored away between the stones; also several warm nests, which the fire had not reached, about the size of a peck measure, of soft plant fibers; but there were no holes or burrows in the ground under the stones. Specimens were sometimes obtained by setting fire to the nests and shooting the rats as they ran out, but they were usually very reluctant to leave their habitations, and many were severely singed before they would forsake their domiciles. One wood-rat of Fort Verde had the habit of carrying its food to the stump of a willow, 6 feet above its brush pile, when feeding at early morn and was not disturbed by my passing by, though I often stopped to watch it. The rat mounds along the Verde River were sometimes composed entirely of cow "chips," in quantity sufficient to have filled a cart. In a nest of the white-throated wood-rat taken 7 miles south of Bisbee, Arizona, September 17, 1892, were found the following-named substances: Seeds of amaranth (*Amarantus reflexus*), flowers and fruit of gourd (*Cucurbita digitata*), pieces of agave caudex in considerable amount, pieces of bark (*Fouquiera* and *Juniperus*), pieces of stem of a spiny and gummy shrub, and small round stones. Outwardly this nest was composed of coarse sticks and cow-dung.

In the forest zone of red juniper, some species of wood-rats heap quantities of sticks and cow-dung around the tree trunks and even carry them into the lowest forks of the largest branches, where their nests were quite frequently seen, especially on the road from Prescott to Ash Fork, Arizona. As no specimens were obtained from this region, the identity of the rat that builds these large and conspicuous nests remains uncertain. I sometimes saw the nests among cacti as well as around the trunks of the juniper trees, and a few rat houses were placed in open spaces among scoriaceous rocks. I frequently saw the rats gathering the fruit of the juniper from the trees; and their houses were seen throughout the juniper zone on the high bluffs bordering the south side of the Colorado River from Cataract Creek to Diamond Creek Canyon. Wood-rats were noted as "very common," November 10, 1884, through 27 miles of Cataract Canyon, and at the Havasupai Indian village. The Havasupai occupy the lowest portion of Cataract Creek Canyon, where they cultivate the land, and store their dried pumpkins, peaches, Indian corn, and other produce in caches in the walls of the canyon, and seal them up tight with a kind of mud cement and stone walls to protect them from wood-rats and spermophiles.

The wood-rat has many enemies. Indians kill and eat them. The Hopi call this species *Kee-hua' Cahl'-ā*, and pronounce its flesh a delicacy. Captain Martinez, of the army engineer corps of Mexico, informed me that physicians of northern Mexico commonly order broth made from the wood-rat for the Indians and peasants whom they are called upon to treat—just as our physicians prescribe chicken broth and beef tea. Bones of *Neotoma albigula* were numerous in the cave-like human habitations so abundant in the Verde Valley. The bones were often found in a charred condition, showing that the rat was probably used as food by this ancient people. On August 15, 1886, at Fort Verde, the first sergeant of Company K, Ninth Infantry, brought me a diamond rattlesnake, weighing $4\frac{9}{16}$ pounds, which contained a wood-rat. Hawks and owls also devour this rat. A western red-tailed hawk, taken January 16, 1887, at Fort Verde, had eaten one, swallowing it bones, hair, and all. Barn owl pellets from a nest in the bluff clay bank of the Verde River, on July 30, 1885, contained bones of this wood-rat, and of smaller mammals, together with a quantity of hair and remains of small birds.

White-throated wood-rats are born at all seasons of the year, but perhaps not in winter in the higher portions of its habitat. Two females would have given birth to three young each and four to two each.

In Arizona the distribution of the white-throated wood-rat is quite general except in the highest portions. It was abundant in the Verde Valley. In January, 1885, its cow-dung houses were seen under bushes and cacti all along the route from Fort Verde to Indian Garden, on Oak Creek. One wood-rat was seen on a nest built in the center of a bunch of cacti growing in a scrub-oak bush. On the mesa east of Fort Verde the nests were usually composed of sticks and dry cow manure in varying proportions. Between Fort Verde and Fossil Creek large piles of sticks and cow-dung heaps were built up around the trunks of juniper trees by the wood-rat. I found it in the Agua Fria Valley, at Hance's cienega, on Ash Creek, at Antelope and Bumble Bee, and in the Black Canyon between Phoenix and Prescott. It was common at Tucson, Camp Lowell, Mountain Spring, and on the San Pedro River at Tres Alamos.

Along the Mexican Line this species was first met with in the Dog Mountains of New Mexico, where, as usual, it was abundant, as it also was at the east base of the San Luis Mountains, in the vicinity of Monument No. 64; but it was not found on these mountains above 2,100 meters altitude, beyond which it was replaced by *Neotoma* *mexicana bullata*. It was numerous on the upper course of the canyon of Cajon Bonito Creek, near the boundaries of the Mexican States of Chihuahua and Sonora, and was also abundant in the San Bernardino Valley, Sonora. At Niggerhead Mountain, south of Monument No. 82, its nests were particularly numerous. In the Mule Mountains, Arizona, it was likewise abundant. On August 6, 1893, I took a specimen at the altitude of 6,650 feet on San Jose Mountain, Sonora, and subsequently one was entrapped among the stones composing the monument at the summit.[a] It was abundant in the Huachuca Mountains, except near the summit, where it was replaced by *Neotoma mexicana bullata*. It occurs throughout the San Pedro and Santa Cruz valleys. When collecting in the Patagonia Mountains, Sonora, Mr. Holzner noted that "this wood-rat lives in rocks; builds no house;" also that the specimens collected there by him had the iris very dark brown and had two pairs of mammæ (inguinal). We took several specimens in traps set in crevices of rocks at the sides of a sandy arroyo on the Sonora side of the International Boundary near La Osa, Arizona, December 8 to 28, 1893; but the species was uncommon there. It was more abundant at Warsaw, Pima County, Arizona, in November and December, 1893. It was common at Pozo de Luis, Sonora, in December, 1893, and January following. Its houses were often made of joints of cactus; and rat houses were seen in the highest places, oftenest in the center of a large patch of prickly-pear cactus. Some were taken in traps with much difficulty, for they were very shy. The species was not abundant in the Nariz Mountains; but in the Sonoyta Valley, at Sonoyta, Santo Domingo, and Quitobaquita it was not uncommon, nesting about cacti and in brush fences. On February 9, 1894, when I rode from Monument No. 179 west 30 miles to Tule Wells, I saw piles of cactus joints accumulated by wood-rats at a few places, but all were old and uninhabited. A few were found at Tule Wells and at Tinajas Altas, in Arizona. In the Gila River bottom, in the vicinity of Adonde Siding, Arizona, we found it common, especially under the low, spreading mesquites and in piles of driftage beside the Gila River. The examples entrapped were darker than those taken at Tule Wells and Tinajas Altas, away from shade and water. It was not noted west of Gila City.

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[a] *Neotoma mexicana bullata* Merriam was not found on San Jose Mountain.

Record and measurements of 58 specimens of Neotoma albigula.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail vertebræ.	Length of hind foot.	Ear, height from crown.
Skin.	Skull.								
				1885.		*mm.*	*mm.*	*mm.*	*mm.*
[a]2374	1883	254	Near Fort Verde, Arizona	Oct. 2	♂ ad.	315	136	33.0	25.0
[a]2376	1829	279	....do	Nov. 13	♀ ad.	335	152	35.0	26.0
				1886.					
[a]2375	In skin	306	....do	Jan. 7	♀ ad.	360	169	34.0	26.0
				1887.					
[a]2377	1830	489	....do	Feb. 3	♀ ad.	333	146	34.0	27.0
				1888.					
[a]2378	......	660	....do	May 1	♀ ad.	370	162	34.0	27.0
				1892.					
21314	37057	1772	Dog Spring, Grant County, New Mexico.	May 22	♂ juv.	......	......	......	......
20745	37059	2085	San Bernardino Ranch, Monument No. 77.	Sept. 3	♂ ad.	325	117	35.0	21.0
21311	......	2102	....do	Sept. 9	♂ ad.	353	153	37.0	25.0
20679	......	2108	Monument No. 90, near Bisbee, Arizona.	Sept. 17	♂ ad.	312	135	32.5	22.0
20721	35832	827	Patagonia Mountains, near Monument No. 114.	Nov. 21	♂ ad.	333	153	33.0	26.5
20722	35868	835	....do	Nov. 22	♀ ad.	324	148	32.5	24.0
				1893.					
58890	58890	2440	San Jose Mountain, Sonora	Aug. 7	♂ im.	280	127	34.0	22.0
58889	58889	2441	....do	...do	[b] ♀ ad.	......	......	34.0	22.0
......	63106	2442	....do	...do	♀ im.	270	117	33.0	15.0
58887	58887	4246	....do	Aug. 8	♀ ad.	334	137	35.0	22.0
58888	58888	4248	....do	Aug. 9	♂ ad.	335	138	33.0	23.0
58841	58841	2580	Huachuca Mountains, Arizona	Oct. 17	♂ im.	302	136	33.0	23.5
58838	58838	2581	....do	...do	♀ im.	......	......	32.0	24.0
21438	36667	898	....do	Aug. 3	♀.	294	136	30.5	22.0
21439	36668	922	....do	Aug. 11	♀ ad.	306	151	32.0	24.5
21440	36669	928	....do	Aug. 12	♀ ad.	302	149	33.0	26.0
21441	36670	933	....do	Aug. 13	♂ ad.	325	147	32.0	26.0
21442	36671	934	....do	...do	♂ ad.	325	155	33.0	25.0
21443	36672	944	....do	Aug. 16	♀ ad.	329	159	33.0	23.0
21444	36673	945	....do	...do	♂ juv.	286	133	34.0	24.0
21446	36674	954	....do	...do	♂ ad.	336	161	33.0	22.5
21447	36675	973	....do	Aug. 24	♀ ad.	314	142	33.0	24.5
21448	36676	974	....do	...do	♀ juv.	259	129	31.0	19.0
21449	......	975	....do	Aug. 25	♂ juv.	......	......	......	......
21450	36677	985	....do	Aug. 28	♂.	......	......	30.0	22.0
21451	36678	994	....do	Aug. 30	♂ ad.	307	143	32.0	23.0
21455	36681	1024	....do	Sept. 10	♀ ad.	312	155	32.0	21.0
58892	58892	2522	Dog Spring, Grant County, New Mexico.	Sept. 17	♀ ad.	333	147	32.5	24.0
58891	58891	2541	....do	Sept. 19	♀ ad.	336	147	33.5	23.0

[a] American Museum of Natural History.

[b] Head and Body 185 mm.

Record and measurements of 58 specimens of Neotoma albigula—Continued.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail vertebræ.	Length of hind-foot.	Ear, height from crown.
Skin.	Skull.								
				1893.		*mm.*	*mm.*	*mm.*	*mm.*
21463	36688	1066	Huachuca Mountains, Arizona	Oct. 3	♀ im.	307	142	34.0	22.0
58839	58839	2583	Town of Santa Cruz, Sonora	Oct. 22	♀ ad.	330	155	34.0	22.5
58840	58840	2601	.....do	...do	♂ ad.	350	161	34.0	22.0
58842	58842	2627	Nogales, Monument No. 122	Oct. 27	[a] ♀ ad.	.....	.....	33.0	24.0
59214	59214	2693	La Osa, near Monument No. 40	Dec. 18	♂ ad.	320	144	36.0	24.0
59216	59216	2702	.....do	Dec. 19	♀ ad.	336	155	35.0	23.0
59215	59215	2703	.....do	...do	♀ ad.	328	152	35.0	23.0
59213	59213	2708	.....do	Dec. 20	♀ im.	295	142	33.5	22.0
				1894.					
59277	59277	2754	Poso de Luis, near Monument No. 152.	Jan. 1	♀ ad.	318	150	32.0	24.0
59275	59275	2757	.....do	Jan. 3	♂ ad.	348	157	34.0	23.0
59279	59279	2759	.....do	Jan. 4	[b] ♂ ad.	.....	.....	33.0	22.0
59280	59280	2760	.....do	...do	♂ ad.	321	153	32.0	22.0
59278	59278	2787	Sonoyta, Sonora, near Monument No. 167.	Jan. 17	♀ ad.	312	153	33.0	24.0
59274	59274	2800	.....do	Jan. 20	♀ ad.	303	140	34.0	21.0
59276	59276	2801	.....do	...do	♂ ad.	321	149	33.0	24.0
59281	59281	2814	.....do	Jan. 21	♂ ad.	330	156	31.5	23.5
63107	63107	2948	Tule Wells, near Monument Mo. 186	Feb. 11	♀ ad.	320	155	32.5	24.5
63108	63108	2959	.....do	Feb. 13	♂ ad.	308	145	33.0	24.0
63109	63109	2960	Near Monument No. 187	...do	♂ ad.	337	162	33.0	25.0
141833	141833	2995	Tinajas Altas, Arizona, near Monument No. 191.	Feb. 19	[c] ♀ ad.	.....	.....	34.0	25.5
141834	141834	3046	Adonde, Gila River, Arizona	Feb. 26	[d] ♀.	.....	.....	33.0	23.5
141835	141835	3057	Adonde station, S. Pa. R. R., Gila River, Arizona.	Feb. 27	♀ ad.	342	170	36.0	24.0
141836	141836	3058	.....do	...do	♀ ad.	343	165	35.0	25.0
141837	141837	3064	.....do	Feb. 28	♀ ad.	340	158	36.0	22.0

[a] Head and body 179 mm.
[b] Head and body 176 mm.
[c] Head and body 170 mm.
[d] Head and body 153 mm.

NEOTOMA ALBIGULA ANGUSTICEPS (Merriam).

EASTERN DESERT WOOD-RAT.

Neotoma intermedia angusticeps Merriam, Proc. Biol. Soc. Wash., IX, p. 127, July 2, 1894, (original description).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 105 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Neotoma intermedia*] *angusticeps*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 162 (Synop. Mam. N. Am.); IV. 1904, p. 285 (Mam. Mid. Am.).

Type-locality.—Apache Mountains, New Mexico, near Monument No. 40. (Type, skin and skull, in the collection of Dr. C. Hart Merriam.)

Geographical range.—Sonoran Zone of the Eastern Desert Tract.

Description.—Size small; coloration pale and cinereous; ear small; mammæ, 2 pairs (in one individual, 3 pairs); skull long and narrow. Length, 320 mm; tail vertebræ, 150; hind foot, 34; ear, 22. Skull, 46 mm by 23.5. The upper coloring is a mixture of ochraceous and cinereous. Below, as usual in desert forms, the white tips to the hairs are much broader than in others.

Remarks.—The type of this form did not come from the extreme "S. W. corner of Grant Co., New Mexico," a locality that Mr. Anthony, the collector, never visited, but from a point in the Apache Mountains, well to the eastward of the high San Luis range of mountains, and not far from Monument No. 40, of the Mexican Line. The southwest corner of Grant County is well within the range of true *albigula*, with the broad Animas plain, and the San Luis, Dog, and Hachita ranges of mountains between it and the type-locality of this animal, which came from the western edge of the Eastern Desert—a very different faunal area. A large series of topotypes of *Neotoma intermedia angusticeps*, from the vicinity of Monument No. 40, Doyle's Well, and Hachita Grande Mountain, furnish several examples that agree closely with the Eastern Desert form, while others of the series are indistinguishable by cranial or external characters from typical *N. albigula* from Tucson and Fort Lowell. In other words, the locality is the intergrading ground of the two forms, and according to usage, it falls to the lot of the first reviewer to decide whether the form *angusticeps* shall be kept separate from true *Neotoma albigula*, or be allowed to stand for the desert form to the eastward. I have decided upon the latter course, though there are specimens in our collection taken 50 miles farther east that are practically indistinguishable from true *albigula*. In the region around El Paso, Texas, this desert race finds its extreme expression in a small, pale, ash-colored or buffy animal. At a camp 50 miles west of the Rio Grande (Monument No. 15), where black obsidian rocks and areas of pale reddish sand were in close proximity, dark and pale forms were collected practically together. One of the darkest had the under surface strongly washed with salmon color, in this respect, being unique in our large series of specimens of the *Neotoma albigula* group.

Habits and local distribution.—This wood-rat often builds its nest among the joints of large prickly-pear cacti, but it also lives among rocks, and one was trapped in a cavernous hollow under a cliff. At El Paso, it was rather common in rocky situations, and ascended to the summit of the neighboring Franklin Mountains. It was found at every camp thence westward to the Hachita Mountains. I found it at Steins Pass, Lordsburg, and Separ, New Mexico, in April, 1885. Three females taken at Monument No. 15, March 31 and April 3, 1892, contained 2, 1, and 3 fetuses, respectively.

Record and measurements of 32 specimens of Neotoma albigula angusticeps.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail vertebræ.	Length of hind-foot.	Ear, height from crown.
Skin.	Skull.								
				1892.		*mm.*	*mm.*	*mm.*	*mm.*
20098	35461	1533	El Paso, Texas	Mar. 4	♀ ad.	274	127	29.0	23.0
20099	35462	1534	.....do	Mar. 5	♂ ad.	300	132	34.0	22.5
20278	35592	1568	Monument No. 15, 50 miles west of El Paso, Texas.	Mar. 23	♂ ad.	364	163	34.0	20.0
20263	35621	1588	.....do	Mar. 26	♀ ad.	314	131	33.0	23.0
20266	35617	1599	.....do	Mar. 29	♂ ad.	337	146	33.0	23.0
20261	35571	1600	.....do	....do...	♂ ad.	337	153	35.0	24.0
20277	35580	1604	.....do	Mar. 30	♀ ad.	265	119	31.0	21.0
20269	35616	1607	.....do	Mar. 31	♀ ad.	328	140	32.0	21.0
20260	35579	1626	.....do	Apr. 3	♂ ad.	330	147	34.0	22.0
20262	35532	1627	.....do	....do...	♀ ad.	312	134	34.0	23.0
20267	35534	1628	.....do	....do...	♀ ad.	333	145	35.0	22.0
20264	35586	1631	.....do	Apr. 4	♀ ad.	322	144	33.0	22.0
20259	35596	1644	.....do	Apr. 6	♂ ad.	333	136	34.0	22.5
20268	37051	1668	Carrizalillo Mountain, near Monument No. 32.	Apr. 18	[a] ♂ ad.	......	......	32.0	24.0
20275	35570	1671	.....do	....do...	♂ juv.	223	94	31.0	23.0
20272	35553	1683	Upper Corner, Monument No. 40	Apr. 23	♀ ad.	335	152	35.0	25.0
20273	35591	1684	.....do	....do...	♂ ad.	315	140	37.0	23.5
20274	35573	1689	.....do	Apr. 25	♀ ad.	320	144	33.0	24.0
20271	35625	1690	.....do	....do...	♂ ad.	325	127	33.0	23.0
20270	35628	1691	.....do	....do...	♀ ad.	319	138	34.0	25.0
20265	35575	1698	.....do	Apr. 26	♀ ad.	291	129	33.0	23.0
20257	35531	1710	.....do	Apr. 28	♂ ad.	340	137	33.0	22.0
21308	37049	1712	.....do	Apr. 29	♂ juv.	209	82	30.0	20.0
21309	37052	1714	.....do	Apr. 30	♂ ad.	333	153	35.0	22.0
20256	35634	1724	.....do	May 1	♂ juv.	262	112	34.0	20.0
21312	37053	1735	.....do	May 4	♂ ad.	310	130	34.0	22.0
20258	35533	1756	.....do	May 10	♂ ad.	332	141	34.0	20.0
21313	37054	1762	.....do	May 13	♀ ad.	327	138	32.0	23.0
21310	37055	1764	.....do	May 14	♂ ad.	346	148	35.0	23.0
20680	37056	1766	.....do	May 15	♂ juv.	......	......	......	......
20746	37058	1814	Big Hachita Mountain, Grant County, New Mexico.	May 23	♂ im.	280	123	31.0	22.0
20744	35915	1816	.....do	May 25	♂ ad.	330	144	32.0	25.0

[a] Head and body, 183 mm.

NEOTOMA INTERMEDIA Rhoads.

RHOADS WOOD-RAT.

Netoma intermedia Rhoads, American Naturalist, XXVIII, p. 69, Jan., 1894, (from Dulzura, San Diego County, California; original description).—Merriam, Proc. Acad. Nat. Sci. Phila., 1894, p. 247 (in part; the subspecies *gilva* is included).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 105 (Syst. Results Study N. Am. Mam. to close of 1900).

Neotoma californica Price, Proc. Calif. Acad. Sci., 2d ser., III, p. 154, May 9, 1894 (from Bear Valley, San Benito County, California).

Neotoma intermedius, Rhoads, American Naturalist, XXVIII, p. 69 (in text), Jan. 1, 1894.

[*Neotoma*] *intermedia*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 161 (Synop. Mam. N. Am.); IV, 1904, p. 284 (Mam. Mid. Am).

Type-locality.—Dulzura, San Diego County, California. (Type, skin and skull, in the collection of S. N. Rhoads, of Philadelphia.)

Geographical range.—Sonoran Zone of the Pacific Coast Tract of California and Lower California.

Description.—Size medium. Length, 320 mm.; tail vertebræ, 150; hind foot, 34; ear, 24. Skull, 44 by 21. Tail sharply bicolor, short, and tapering. Color above superficially brownish gray, with a slight tinge of olive, and thickly lined with blackish; basal portion of the pelage dark plumbeous. Head more grayish, lacking the olive tone. Tail blackish above, white on sides and below. Feet all pure white, except the bare soles, which are flesh-color, those of *Neotoma fuscipes macrotis* being of a livid, purplish color. Under surface of head and body white, or very faintly tinged with ecru-drab across the abdomen; underfur and basal portion of the long hair plumbeous, the color often showing through, between the white tips. Ears rather large, scantily coated with dark, drab-colored hairs.

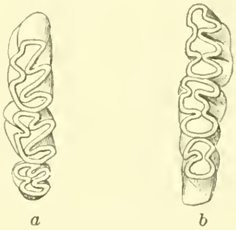

FIG. 119.—NEOTOMA INTERMEDIA. CROWNS OF MOLAR TEETH OF A YOUNG INDIVIDUAL. *a*, UPPER SERIES; *b*, LOWER SERIES.

Cranial and dental characters.—The skull of this species combines the cranial characteristics of *Neotoma mexicana* and *N. leucodon.* The front upper molar (fig. 119) is relatively broad and has the anterior one of the three transverse loops into which the tooth is divided but faintly notched by the antero-internal groove. There is a plainly marked supraorbital bead. The interpterygoid space is remarkably contracted. The frontals are shaped much as in *N. mexicana,* not suddenly bulging posteriorly.

Habits and local distribution.—The Rhoads wood-rat usually lives among cactuses; but one individual was shot from an oak tree. It not infrequently travels about during the day, though it is chiefly nocturnal.

Measurements of 27 specimens of Neotoma intermedia.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail vertebræ.	Length of hind-foot.	Ear, height from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
60986	60986	3545	Jacumba Springs, near Monument No. 233.	May 20	♀ ad.	308	149	33.0	23.0
60989	60989	3560	.....do	May 22	♀ ad.	308	147	32.0	24.0
60996	60996	3746	San Isidro Ranch, Lower California, near Monument No. 249.	July 2	♂ ad.	336	158	34.0	27.0
60997	60997	3747	.....do	....do...	♂ ad.	314	144	32.0	24.0
a8234	6577	1518	.....do	June 29	b ♂ ad.	.....	.....	35.0	22.0
60688	60688	1519	.....do	....do...	♂ ad.	317	149	34.0	24.0
60690	60690	1533	.....do	June 30	♂ ad.	324	152	34.0	25.0
a8236	6579	1534	.....do	....do...	♀ ad.	329	153	33.0	25.0
60689	60689	1535	.....do	....do...	♀ ad.	328	156	33.0	24.0
a8237	6580	1541	.....do	July 1	♀ ad.	311	145	32.0	24.0
a8238	6581	1545	.....do	July 2	♂ ad.	344	166	35.0	24.0
60691	60691	1546	.....do	....do...	♂ ad.	329	153	33.0	23.0
a8239	6582	1547	.....do	....do...	♂ ad.	335	168	33.5	24.0
60692	60692	1548	.....do	....do...	♂ ad.	339	158	35.0	25.0
60694	60694	1556	.....do	July 3	♂ ad.	340	160	35.0	27.0
60695	60695	1558	.....do	....do...	c ♂ ad.	.....	.....	35.0	23.0
a8243	6586	1559	.....do	....do...	♂ ad.	320	150	33.0	23.0
60998	60998	3756	Cottonwood Creek, Lower California, near Monument No. 252.	....do...	♂ ad.	345	161	34.0	23.0
61000	61000	3761	Jamul Creek, near El Nido, San Diego County, California.	July 6	♂ ad.	355	172	35.0	21.0
				1895.					
a8247	6590	1581	.....do	July 7	♀ ad.	318	147	33.0	22.0
......	......	1654	Santee Mountains, San Diego County, California.	June 1	♀ ad.	336	159	34.0	25.0
......	......	1657	.....do	May 31	♂ ad.	.....	.....	35.0	26.0
......	......	1623	.....do	May 18	♀ ad.	310	151	33.0	25.0
......	......	1655	.....do	May 30	♂ im.	310	161	33.0	26.0
......	......	1644	.....do	May 26	♂ ad.	319	150	35.0	24.0
......	......	1620	.....do	May 17	♂ juv.	295	146	33.0	24.0
......	......	1613	.....do	May 11	♂ juv.	289	141	31.0	24.0

[a] American Museum of Natural History [b] Head and body, 194 mm. [c] Head and body, 188 mm.

NEOTOMA INTERMEDIA GILVA Rhoads.

BANNING WOOD-RAT.

Neotoma intermedia gilva Rhoads, American Naturalist, XXVIII, Jan. 1, 1894, p. 69 (original description).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p 106 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Neotoma intermedia*] *gilva*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 162 (Synop. Mam N. Am.).

Type-locality.—Banning, San Bernardino County, California.

Geographical range.—Lower Sonoran Zone of the Western Desert Tract.

Description.—Similar to *Neotoma intermedia* except in color, but slightly smaller. Upper parts cinereous-buff; under parts white: tail buffy all round at base.

Measurements (Cat. No. 60982, U.S.N.M., adult male from the east base of the Coast Range Mountains, near Monument No. 228).—Total length, 348 mm; tail vertebræ, 174; hind foot, 34; ear from crown, 27. Skull, 42 by 20.

Remarks.—Mr. Rhoads's type, from Banning, is an intermediate, not typical of the desert phase of this species, but, as it is not clearly the subspecies *intermedia*, I prefer to consider it as representing the present form rather than to apply a new name. I am indebted to Mr. Rhoads for the privilege of comparing the type.

Measurements of 10 specimens of Neotoma intermedia gilva.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail vertebræ.	Length of hind-foot.	Ear, height from crown.
Skull.	Skin.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
60982	60982	3507	East base of Coast Range Mountains, near Monument No. 230.	May 8	♂ ad.	348	174	34.0	27.0
60983	60983	3513	Mountain Spring, east slope of Coast Range Mountains, California.	May 10	♀ ad.	330	165	34.0	28.0
60684	60684	1217	.....do	May 11	♀ ad.	314	144	32.0	25.0
[a]8228	6572	1275	Jacumba Springs, near Monument No. 233.	May 18	♂ ad.	310	148	35.0	23.0
[a]8229	6573	1312	.....do	May 22	♀ ad.	305	142	34.0	23.0
[a]8230	....	1333	.....do	May 24	♀ ad.	294	135	31.0	26.0
[a]8231	6574	1336	.....do	May 25	♂ im.	284	139	32.0	26.0
60987	60987	3546	.....do	May 20	♂ juv.	288	138	32.0	23.0
60988	60988	3557	.....do	May 21	♂ juv.	225	100	......	......
60991	60991	3622	Nachoguero Valley	June 4	♀ ad.	304	140	34.0	26.0

[a] American Museum of Natural History.

NEOTOMA DESERTORUM Merriam.

HERMIT WOOD-RAT.

Neotoma desertorum MERRIAM, Proc. Biol. Soc. Wash., IX, p. 125, July 2, 1894 (original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 103 (Syst. Results Study N. Am. Mam. to close of 1900).

?*Neotoma lepida* THOMAS, Ann. and Mag. Nat. Hist., 6th ser., XII, Sept., 1893, p. 106. (From Williams Spring, about lat. 40°, long. 113°, just south of Champlin Mountains, Juab County, Utah. Altitude, 4,558 feet).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 106.

[*Neotoma*] *desertorum*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 161 (Synop. Mam. N. Am.).

?*Neotoma cinerea lepida*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 429 (appendix to Synop. Mam. N. Am.).

Type-locality.—Furnace Creek, Death Valley, California. (Type, skin and skull, Cat. No. $\frac{25739}{33139}$, U. S. National Museum, Biological Survey collection.)

Geographical range.—Upper and Lower Sonoran zones of the Western Desert Tract.

Description.—Size, small. Length, 300 mm.; tail vertebræ, 125; hind foot, 30; ear from crown, 27. Ears, large. Pelage remarkably long, soft, and silky. Color above ochraceous buff; head smoke gray; under parts, white, sometimes faintly washed with pinkish buff; tail, bicolor, dusky above, white below.

Cranial and dental characters.—Skull light, with remarkably large tympanic bullæ.

Remarks.—On the Mexican Line this beautiful species has been found only at Yuma, on the Colorado River.

NEOTOMA FUSCIPES MACROTIS (Thomas).

SAN DIEGO WOOD-RAT.

Neotoma macrotis THOMAS, Ann. and Mag. Nat. Hist., 6th Ser., XII, Sept., 1893, pp. 234, 235 (from San Diego, California; original description).

Neotoma macrotis simplex TRUE, Proc. U. S. Nat. Mus., XVII, 1894, p. 354 (advance sheet issued June 27, 1894). (A pale interior form).

Neotoma fuscipes macrotis, MERRIAM, Proc. Acad. Nat. Sci. Phila., 1894, p. 242.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 104 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Neotoma fuscipes*] *macrotis*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 159 (Synop. Mam. N. Am.).

Type-locality.—San Diego, California. (Type, skin and skull, in the British Museum.)

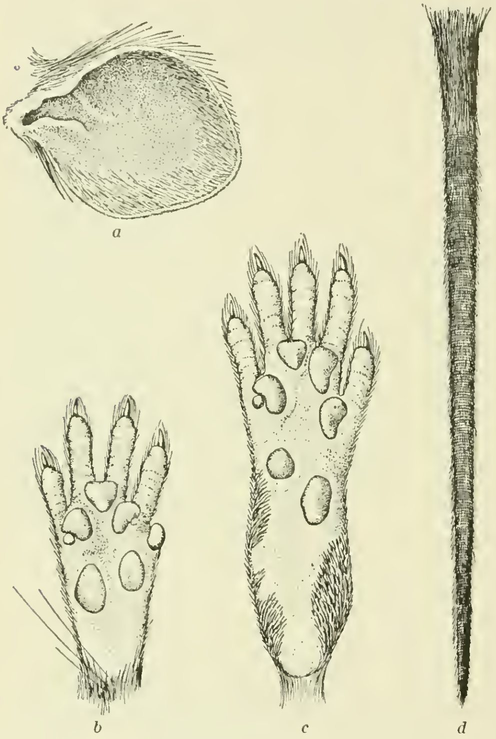

FIG. 120.—NEOTOMA FUSCIPES MACROTIS. *a*, EAR; *b*, FOREFOOT; *c*, HINDFOOT; *d*, TAIL.

Geographical range.—Pacific Coast Tract of southern and Lower California; inhabits the Sonoran Zone.

Description.—Size, rather large. Length, 370 mm.; tail vertebræ, 170; hind foot, 35; ear from crown, 25; Skull, 47 by 25. Above russet-drab, mixed with blackish; head and limbs mouse-gray; feet (fig. 120*b* and *c*) with the usual white color more or less replaced by dusky or blackish down to the toes; under surface, white (except the tail), more or less washed with ochraceous buff across the abdomen; tail (fig. 120*d*) not distinctly bicolor, but black, slightly mixed with gray above and sooty grayish below; ears (fig. 120*a*) large, scantily haired, faintly edged with grayish white, and blackish on anterior third of convex surface. Young, mouse-gray above, white below, with feet and tail dusky.

Cranial and dental characters.—The skull of this species is readily distinguishable from that of *Neotoma intermedia* of the same region by its larger size, peculiar shape, and much wider interpterygoid fossa. The anterior loop of the first upper molar is not divided by a sulcus as it is in *N. mexicana.*

Remarks.—I have examined specimens that were intermediate in characters, both external and cranial, between *Neotoma fuscipes macrotis* and *N. intermedia.* They were found in leaf-nests in oak trees, and I am disposed to consider them as hybrids between the two species. *Neotoma fuscipes macrotis* is an arboreal species, building its nests in hollow trees or among their branches, while *N. intermedia* resides in the open country, usually making its home among the cactuses.

Habits and local distribution.—The San Diego wood-rat builds its nest in tall evergreen oaks. The nest, which is composed largely of twigs and leaves of the oak, resembles that of the eastern gray squirrel. I once set fire to a nest and saw, besides the wood rats, two large tree lizards (*Sceloporus*) come out of it. This species does not always remain near trees. On July 3, 1894, I saw one in a clump of cactuses on Cottonwood Creek, Lower California, and shot it from my horse. The spot was a dry, open waste, perhaps 5,000 yards from the stream. Several of our specimens were obtained by shooting into nests.

Measurements of 12 specimens collected of the genus Neotoma fuscipes macrotis.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail vertebræ.	Length of hind-foot.	Ear, height from crown.
Skin.	Skull.								
				1894.		*mm.*	*mm.*	*mm.*	*mm.*
60985	60985	3532	Jacumba Springs, near Monument No. 233.	May 18	♂ ad.	430	166	35.0	23.0
60684	60684	3616	Nachoguero Valley, Lower California.	June 2	♂ ad.	377	180	37.0	25.5
60682	60682	1335	Jacumba Springs, San Diego County, California.	May 25	♂ ad.	.....	.....	36.0	28.0
60685	60685	1409	Nachoguero Valley, Lower California.	June 5	♂ ad.	366	167	35.0	25.0
[a]8233	6576	1414	.....do.....	June 6	♀ ad.	365	189	37.0	29.0
60686	60686	1514	Tecate Valley, Lower California...	June 27	♂ ad.	340	179	37.0	30.0
[a]8235	6578	1532	San Isidro ranch, near Monument No. 250	June 30	♀ ad.	360	170	36.0	25.0
60696	60696	1572	Jamul Creek, near El Nido, San Diego County, California.	July 6	♀ im.	330	157	36.0	24.0
60698	60698	1579	.....do.....	July 7	♀ ad.	362	161	37.0	28.0
60905	60905	1596	.....do.....	July 8	♂ im.	.....	.....	.....	.....
61644	(b)	3757	.....do.....	July 4	♂ ad.	350	166	34.0	25.0
61645	(b)	3758	.....do.....	...do...	♂ ad.	354	181	37.0	27.0

[a] American Museum of Natural History.

(b) Alcoholic.

NEOTOMA PINETORUM Merriam.

PINE WOOD-RAT.

Neotoma pinetorum MERRIAM, Proc. Biol. Soc. Wash., VIII, p. 111, July 31, 1893 (original description).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., No. 1, Dec. 27, 1901, p. 108 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Neotoma*] *pinetorum*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 158 (Synop. Mam. N. Am.).

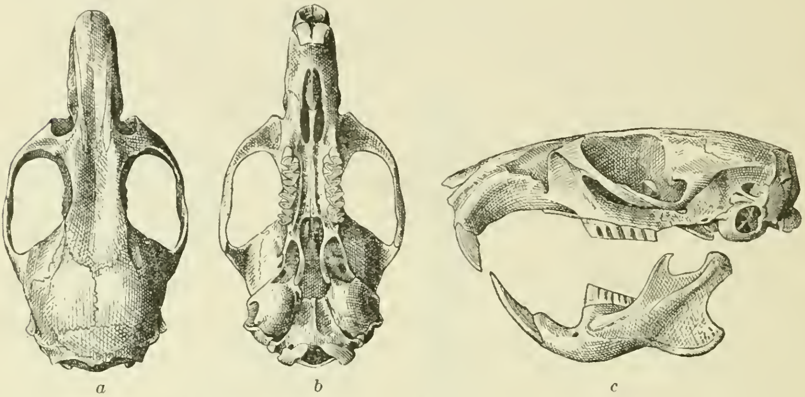

FIG. 121.—NEOTOMA PINETORUM. SKULL. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

Type-locality.—San Francisco Mountain, Arizona. (Type, skin and skull, Cat. No. $\frac{25739}{33139}$, U. S. National Museum, Biological Survey collection.)

Geographical range.—Forested areas of the Colorado Plateau in northeastern Arizona. Transition and Lower Boreal zones.

Description.—Similar to *Neotoma mexicana*, but much larger, and of a darker, more fulvous color on the upper surface. Length, 360 mm.; tail vertebræ, 160; hind foot, 37; ear from crown, 25. Skull, 47 by 24 (adult male from Baker's Butte, Yavapai County, Arizona). Above fulvous, thickly lined with black-tipped hairs; under surface and feet, white; tail black above, white below; sides of face, grayish.

Cranial and dental characters.—The skull and teeth (figs. 121 and 122), though much heavier than in *Neotoma mexicana*, have much the same character. The interpterygoid space is remarkably long and narrow.

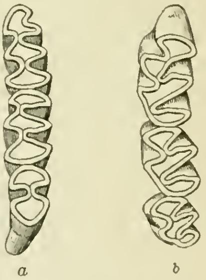

FIG. 122.—NEOTOMA PINETORUM. CROWNS OF MOLAR TEETH. *a*, LOWER SERIES; *b*, UPPER SERIES.

Remarks.—This species does not reach the Mexican Line, but was included in my earlier collections, made in Arizona from 1884 to 1888.

Habits and local distribution.—This rat builds large nests in thickets and stumps of trees. It enters houses freely. At Bakers Butte (altitude, 8,000 feet) I trapped a specimen in a cabin; and the species was abundant at Flagstaff and San Francisco Mountain in 1886 and 1887, when it was also found at Quaking Asp Settlement on the Mogollon Mesa. I never obtained any of the rats from the large nests so abundant in the red juniper trees of northern Arizona, and do not know whether they were made by this or some other species of wood rat. Doctor Bishop collected the pine wood-rat at Bill Williams Mountain, Arizona, in 1883.

NEOTOMA MEXICANA Baird.

CHIHUAHUA WOOD-RAT.

Neotoma mexicana BAIRD, Proc. Acad. Nat. Sci. Phila., VII, 1855, p. 333 (near Chihuahua, Mexico; original description).—MERRIAM, Proc. Acad. Nat. Sci. Phila., 1894, p. 245.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 106 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Neotoma*] *mexicana*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 158 (Synop. Mam. N. Am.); IV, 1904, p. 282 (Mam. Mid. Am.).

Type-locality.—Mountains near Chihuahua, Mexico.

Geographical range.—Tops of the desert ranges of the Chihuahuan region, extending into the United States in southwestern Texas and southeastern New Mexico.

Description.—Size, small. Length, 335 mm.; tail vertebræ, 150; hind foot, 35; ear from crown, 22; skull, 42 by 20.5. Color of upper side of body pale ochraceous buff mixed with gray and black; head and legs, grayish; underfur plumbeous; under surface of head and body, feet, and under side of tail white.

Cranial and dental characters.—Skull with front loop of first upper molar completely divided by a deep sulcus formed by the infolding of the enamel, exactly as in *Neotoma pinetorum*. Nasal bones broad, often truncate posteriorly, ending evenly with the premaxillaries behind. Orbital margin upturned and forming a distinct crest.

NEOTOMA MEXICANA BULLATA Merriam.

APACHE WOOD-RAT.

Neotoma mexicana bullata MERRIAM, Proc. Biol. Soc. Wash., IX, p. 120, July 2, 1894 (Santa Catalina Mountains, Arizona: original description); Acad. Nat. Sci. Phila., 1894, p. 245.—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 107 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Neotoma mexicana*] *bullata*, ELLIOT, Field Col. Mus., Zool. Ser., II, 1901, p. 158 (Synop. Mam. N. Am.).

Type-locality.—Santa Catalina Mountains, Arizona. (Type, skin and skull, Cat. No. $\frac{16863}{23774}$, U. S. National Museum, Biological Survey collection.)

Geographical range.—Transition Zone, on mountains of the Elevated Central Tract, in places touching the lower edge of the Boreal Zone.

Description.—Similar to typical *Neotoma mexicana*, but darker, with peculiar audital bullæ. Above clay color, grayish on head and limbs, thickly lined with black-tipped hairs; sides buffy; underfur plumbeous; feet and under suface white. Mammæ, 2 pairs. Length, 350 mm.; tail vertebræ, 175; hind foot, 35; ear from crown, 20; skull, 44 by 21.

Cranial and dental characters.—The anterior loop of the first upper molar is completely divided by an infolding of the enamel. The nasals are truncate posteriorly and end flush with the premaxillaries behind. The orbital rim is elevated and sharp, making the interorbital portion of the frontal bone strongly concave longitudinally, and the interpterygoid space is narrow. As noted by Merriam, the audital bullæ, which are rather small, are sometimes "curved toward median line anteriorly in a manner not observed elsewhere in the genus;" but this peculiarity is by no means constant.

Remarks.—This slightly marked race occupies the spruce and pine zones on the mountains southwest of the Colorado Plateau, in the latter region being replaced by a larger but closely allied species, *Neotoma pinetorum*. On the Mexican Line we found it only on the highest portions of the San Luis and Huachuca mountains. Externally it is very similar to *Neotoma intermedia albigula* of the same region, but may be distinguished by its smaller size and more grayish head.[a]

Record and measurements of 8 specimens of Neotoma mexicana bullata.

Museum number.		Collector's number.	Locality.	Date.	Sex and age.	Length.	Tail vertebræ.	Length of hind-foot.	Ear, height from crown.
Skin.	Skull.								
				1892.		*mm.*	*mm.*	*mm.*	*mm.*
20516	35743	2012	San Luis Mountains	July 18	♀ ad.	325	160	36.0	22.0
				1893.					
21452	36679	1001	Huachuca Mountains, Arizona	Sept. 1	♂ ad	343	162	34.0	20.0
21456	36682	1033	....do	Sept. 14	♀ ad.	234	169	32.0	20.5
21457	36683	1034	....do	Sept. 15	♀ ad.	322	164	32.0	20.0
21458	36684	1036	....do	Sept. 18	♂ ad.	351	176	33.0	20.0
21459	36685	1037	....do	Sept. 19	♀ im.	......	......	......	......
21460	36686	1042	....do	Sept. 20	♂ ad.	317	155	32.0	18.0
21461	37050	1043	....do	Sept. 21	♀ ad.	334	169	33.0	20.0

[a] The following two species have been described from localities not far from the Mexican Boundary:

NEOTOMA BELLA Bangs.

PRETTY WOOD-RAT.

Neotoma bella Bangs, Proc. New England Zool. Club, I, July 31, 1899, p. 66 (original description).—Miller and Rehn, Proc. Boston Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 101 (Syst. Results Study N. Am. Mam. to close of 1900).—Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 429 (Synop. Mam. N. Am.).

The original description of this rat by Mr. Bangs is as follows:

Type-locality.—Palm Springs, Riverside County, California.

General characters.—Belonging to the *intermedia-lepida* group. Size larger than *N. lepida*

Subfamily MICROTINÆ.

LEMMINGS and VOLES.

Cranium abruptly and strongly constricted immediately in front of the brain case, which is quadrangular, projecting squarely into the orbit; orbital and temporal fossæ well differentiated; jugal forming half, or more than half, of outer side of zygoma and always reaching forward more than halfway from squamosal root to maxillary plate; sagittal area subquadrate, usually broader than long; angular process of mandible narrow, everted, hamular, and thickened at end; infracondylar notch low and deep. (*Merriam.*)

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and smaller than *N. intermedia gilva.* Color very much paler than in either; tail well haired, very light in color and scarcely darker above than below. Skull differing from that of *N. intermedia gilva* in being smaller with shorter, heavier rostrum and wider nasals; audital bullæ larger, interparietal narrower. From *N. lepida* it differs in having rather narrower brain case, heavier rostrum, shorter nasals, with maxillary arms extending farther backward behind them; audital bullæ larger.

Color.—Upper parts pale buff yellow, somewhat lined along back with brownish, black-tipped hairs; a white patch at base of ear; cheeks, sides, and upper surfaces of legs and arms pale orange buff; head pale grayish buff yellow; whiskers mixed black and white; under parts pure white—no pectoral collar—the hairs white to the base, except along lower sides and on under surface of legs where they are pale gray at base; white of under parts extending very high up on sides; tail well haired, white below, yellowish white above, slightly darker, more grayish toward tip above; feet and hands white; ears large, nearly naked, pale grayish (probably nearly flesh color in life).

Measurements.—Type, male, old adult; total length, 317; tail vertebræ, 155; hind foot (from dried skin), 31.5 mm.

Skull, type: Basal length, 37.2; occipitonasal length, 41.4; zygomatic width, 22.2; mastoid width, 16.6; interorbital width, 6; length of nasals, 16.2; length of upper tooth row, alveoli, 8; length of single half of mandible, 26 mm.

Remarks.—*Neotoma bella* probably occurs with *N. intermedia gilva.* Mr. Thurber took the latter at Whitewater, only a few miles from Palm Springs and in the same desert country.

Mr. G. S. Miller, jr., has most kindly compared my type with the type of *N. venusta* True, and writes me that it is not that animal, which is close to if not identical with *N. intermedia gilva. N. bella* can be told at once from *N. intermedia gilva* by its smaller size and paler and quite different coloration. Its relationship to *N. lepida* is closer, but it is very different in color—much paler and less heavily marked above with dusky tipped hairs; the head in particular is much lighter and the color of the under parts is different. The tail of *N. bella* is peculiar in being pale yellowish white above, not dusky as in *N. lepida.* (Proc. New England Zool. Club, I, 1899, p. 66).

NEOTOMA STEPHENSI Goldman.

STEPHENS WOOD-RAT.

Neotoma stephensi GOLDMAN, Proc. Biol. Soc. Washington, XVIII, p. 32, Feb. 2, 1905 (original description).

The following is Mr. Goldman's description:

Type from Hualpai Mountains, Arizona (altitude, 6,300 feet). Adult female, No. 117466, U. S. National Museum Biological Survey Collection. July 1, 1902. F. Stephens. Original number 4192.

General characters.—Size small; fur long, soft, and silky; tail slightly bushy, nearly con-

Incisors broad, molars rootless or rooted, with flat crowns and re-entrant angles.

The subfamily *Microtinæ*, which has been thoroughly revised by Mr. Gerrit S. Miller, jr.,[a] is represented on the Mexican Line by only two genera, *Fiber* and *Microtus*. The former is confined to the neighborhood of streams, and the latter principally to the Transition and Boreal zones of the mountains, although one species inhabits the Sonoran Zone in the coast belt of southern and Lower California.

Genus FIBER Cuvier (1798).

Fiber Cuvier, Tabl. Élém. de l'Hist. Nat. des Anim., p. 141, 1798; Leçons d'Anat. Comp., I, Tab. I, 1800.

Dentition.—I. $\frac{1-1}{1-1}$; M. $\frac{3-3}{3-3}=16$.

Type.—*Castor zibethicus* Linnæus.

Upper incisors with anterior faces smooth. Lower incisors with roots on outer side of molars. Molars rooted. Enamel pattern characterized by approximate equality of re-entrant angles on outer and inner sides of molars. Feet modified for swimming. Tail flattened laterally. (*G. S. Miller, jr.*) (See figs. 123 and 124.)

FIBER ZIBETHICUS PALLIDUS Mearns.

PALE MUSKRAT.

Fiber zibethicus pallidus Mearns, Bull. Am. Mus. Nat. Hist., II, No. 4, Feb. 21, 1890, pp. 280–283 (original description).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 131 (Syst. Results Study N. Am. Mam. to close of 1900).—Elliot, Field Col. Mus., Zool. Ser., IV, 1904, p. 307, fig. 55 (Mam. Mid. Am.).

[*Fiber zibethicus*] *pallidus*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 213 (Synop. Mam. N. Am.).

Type-locality.—Old Fort Verde (now Camp Verde), Yavapai County,

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color; belly pinkish buff. Similar in general to *N. lepida*, but hind foot larger, differing also in color and cranial characters.

Color.—Type: Upper parts grayish buff, palest on head, becoming pinkish buff along cheeks and sides, well mixed on dorsal region with brownish hairs; underparts strongly washed with pinkish buff, this color spreading over entire belly and more or less irregularly invading other parts; small areas on pectoral and inguinal regions, sometimes including throat, pure white; ears thinly covered with grayish brown hairs; ankles dusky; feet white; tail grayish brown, slightly paler below.

Cranial characters.—Skull small, short, and relatively broad; brain case large and smoothly rounded; frontal region broad and flat; bullæ large; first upper molar with antero-internal sulcus obsolete. Compared with *N. lepida* the skull averages larger, with decidedly longer toothrow, larger interparietal, and smaller bullæ.

Measurements.—Type: Total length, 310; tail vertebræ, 139; hind foot, 31. (Proc. Biol. Soc. Washington, XVIII, 1905, p. 32.)

When living at Fort Verde, Arizona, I heard from miners of the existence of a small, somewhat bushy-tailed wood rat on Squaw Peak and others of the Verde Mountains, and now suppose it to have been *Neotoma stephensi*.

[a] North American Fauna, No. 12, July 23, 1896, pp. 1–84, pls. I–III, text figures 1–40.

central Arizona. (Type, skin and skull, in the American Museum of Natural History, New York.)

Geographical range.—Sonoran Zone of the arid interior region of the United States. Its aquatic habits necessarily restrict it to the vicinity of streams. On the Mexican Border we saw it only on the San Pedro River, though it is said to occur on the lower Colorado River, where, however, it was not detected by us, unless some tracks, seen imperfectly at the foot of a clay bluff near Hanlons, were made by a muskrat.

Description.—Similar to *Fiber zibethicus* (Linnæus), but smaller and much paler in color. Size, two-thirds that of the eastern muskrat. General color, rusty brown, paler and grayish beneath; under fur gray, tipped with rusty or yellowish brown; coarse outer hair scanty, glossy brown, reddish in places; whiskers and scattered hairs of tail, rich liver brown.

Measurements.—Average of nine adults (8 males and 1 female) from Fort Verde, Arizona: length, 482 mm. (475–500); tail vertebræ, 204 (171–220); greatest depth of tail, 14 (12–16); distance between eyes, 26 (23–28); ear from crown, 17.3; ear from notch, 19.7; length of head, 69.5 (67–71); length of manus, 31 (28–32); length of pes, 67 (62–70). Skull, 58.8 by 36.3.

Cranial characters.—The skull shows no constant differences from that of the typical form *zibethicus*, except that it is much smaller (58.8 mm. against 65 in total length). A detailed comparison, with ratios of the several measurements to the basilar length, will be found in the original description.[a]

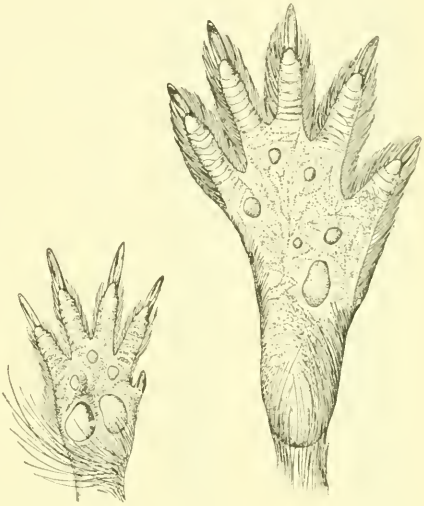

FIG. 123.—FEET OF FIBER ZIBETHICUS. *a*, FOREFOOT; *b*, HINDFOOT.

Habits and local distribution.—Muskrats abound in the waters of the Colorado Basin, and are especially numerous on the Gila and its higher tributaries, but less so near the mouths of the Gila and Colorado rivers. I saw many on the Verde River, where they inhabit burrows along the banks of the stream. At Picks Lake, where muskrats have every advantage for building houses, they never do so, and probably none are built in Arizona, as the weather is not cold enough to make it necessary. I sometimes shot them in the smaller streams, irrigation ditches, and sluices, as well as in the Verde River. On July 8, 1884, while sitting quietly fishing on the river bank, a couple of muskrats were seen swimming toward me. I remained quiet, and one of them swam up to within a few feet of me, and, after diving several times, secured the root it wanted and then climbed out upon the bank within 5 or 6 yards of me and proceeded to devour it quite at leisure, although it cast an occasional furtive glance in my direction. On August 31, 1884, a muskrat also made bold to share our piscatorial sport and swam quietly about the stream, occasionally coming out upon a log to eat the fish it caught. On June 15, 1885, one was seen eating grass in shallow water. When shot, its mouth and stomach contained grass. In the clear water of Beaver Creek I sometimes saw them plunge into the water and watch me from beneath the surface. When walking down this stream in the twilight, September 17, 1885, I shot a muskrat swimming toward me.

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[a] Bull. Am. Mus. Nat. Hist., II, 1890, p. 281.

The muskrat is eaten by the Hualpai Indians, who call it *khu-to,* and by the Hopi, who know it by the name of *pom'-we.* Its bones were plentiful in the ruined buildings and caves of the extinct cliff dwellers.

We obtained no specimens along the Mexican Boundary, but I saw two muskrats in the collection of Col. R. F. Hafford in 1892 which were taken in the San Pedro River, Cochise County, Arizona. We saw no signs of muskrats on the Gila River at Adonde when camped there in February, 1894. Two trappers whom I met at Yuma, Arizona, in March, 1894, had just finished trapping the Arizona portion of the Gila River without meeting with either muskrat or otter, and we had seen no sign of either in our then recent exploration of the lowest part of the Gila. Yuma Indians reported the abundance of muskrats along the Colorado River, but we failed to find them, although I saw some of their tracks at El Rio, on the California side. Near Seven Wells, on Salton River, Lower California, in a hole at the edge of the water I saw something which was supposed to be a muskrat; but I did not see it plainly enough to be certain that it was one, although piles of fresh-water mussel shells, such as they accumulate about their fishing places, were found, making it probable that muskrats lived there On the shores of a good-sized lagoon, near Gardners Station, on the

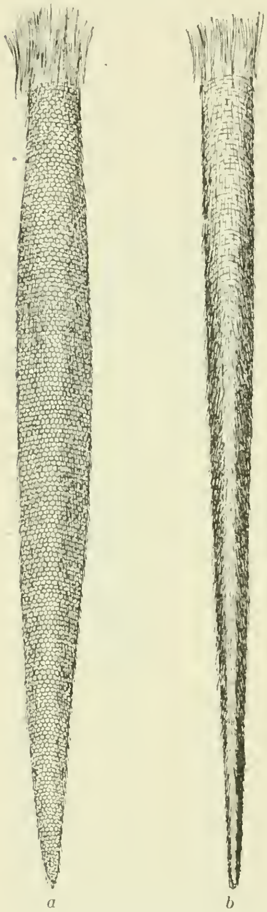

Fig. 124.—Tail of Fiber zibethicus. *a*, lateral view; *b*, dorsal view.

Colorado Desert, where we camped for several days, were numerous heaps of mussel shells, such as muskrats leave about their feeding grounds.

Muskrats have long been known to inhabit the waters of the Colorado River, both above and below Yuma, and in a letter from Mr. Herbert Brown, dated Yuma, Arizona, November 18, 1900, I am informed that he had found them at Yuma.

Measurements of 10 specimens of Fiber zibethicus pallidus.

Collector's number.	Museum number.[a]		Locality.	Date.	Sex and age.	Total length.	Tail from root to end of vertebræ.	Height of ear above crown.	Pes, length (measured on plantar surface).
	Skin.	Skull.							
				1884.		*mm.*	*mm.*	*mm.*	*mm.*
106	2342	([b])	Fort Verde, Arizona	June 26	♂ ad.	......	203	21	62
				1885.					
200	2343	1765	Beaver Creek, Verde Valley, Arizona	June 15	♂ ad.	500	200	17	69
225	2344	1768	Fort Verde, Arizona	July 22	♂ ad.	495	197	19	69
232	2345	1762	....do	Aug. 19	♂ ad.	434	171	13	62
241	2346	1767	Beaver Creek, Verde Valley, Arizona	Sept. 17	[c] ♂ ad.	480	208	15	67
				1886.					
408	......	......	Fort Verde, Arizona	June 4	[d] ♂ juv.	355	......	......	......
451	2347	1766	....do	Aug. 23	♂ ad.	500	212	17.5	70
454	2348	1763	....do	Aug. 28	[c] ♀ ad.	493	210	18	68
464	12181	1764	....do	Sept. 20	♂ ad.	479	213	20	65
				1888.					
663	2349	......	....do	May 15	♂ ad.	475	220	15	67

[a] American Museum of Natural History.
[b] Skull in skin.
[c] Cotype.
[d] Young of the year.

FIBER ZIBETHICUS RIPENSIS Bailey.

PECOS MUSKRAT.

Fiber zibethicus ripensis Bailey, Proc. Biol. Soc. Washington, XV, p. 119, June 2, 1902 (original description).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXXI Aug. 27, 1903, p. 91 (Syst. Results Study N. Am. Mam. during the years 1901 and 1902).

Type-locality.—Pecos River at Carlsbad, formerly Eddy, Eddy County, New Mexico.

Description.—Mr. Vernon Bailey described this subspecies as follows:

Type from the Pecos River at Carlsbad (Eddy), New Mexico, No. 109012, U. S. National Museum, Biological Survey Collection, male ad. Collected July 25, 1901, by Vernon Bailey. Original No. 7757.

General characters.—Size small; color paler than in *zibethicus*, but darker than in *pallidus;* skull narrow; incisors heavy.

Color.—Adults in July: Upper parts light brown without any distinct black; belly buffy brown; throat gray, inclosing a sharp, dusky chin stripe; a small spot over each nostril whitish.

Skull.—Small and narrow; nasals short and rounded or pointed at posterior end, never notched; incisive foramina widest at posterior end; incisors heavy, molars light.

Measurements.—Type: Total length, 470; tail, 202; hind foot, 67. Average of 6 adults:, 463, 204, 68. Skull of type: basal length, 55; nasals, 18; zygomatic breadth, 35; mastoid breadth 25; alveolar length of upper molar series, 15.

Remarks.—This form is distinguished from *zibethicus* by paler color, smaller size, heavier incisors, unnotched nasals, and form of incisive foramina; from *pallidus* by darker color, narrower skull, form of nasals and incisive foramina, and slightly heavier dentition. No other comparisons are necessary. (Proc. Biol. Soc. Washington, XV, 1902, p. 119.)

Genus MICROTUS Schrank (1798).

Microtus SCHRANK, Fauna Boica, I, Pt. 1, 1798, p. 72.—LATASTE, Le Naturaliste, II, 1883, p. 348.—MILLER, North American Fauna, No. 12, July 23, 1896, p. 44 (Genera and Subgenera of Voles and Lemmings).

Arvicola LACÉPÈDE, Mém. de l'Institut, III, 1801, p. 489.

Dentition.—I. $\frac{1-1}{1-1}$; M. $\frac{3-3}{3-3} = 16$.

Type.—*Mus terrestris* Linnæus.

Upper incisors without grooves; lower incisors with roots on outer side of molar series; molars rootless; enamel pattern characterized by approximate equality of re-entrant angles; m_1 usually with 5 closed or nearly closed triangles; M^3 with 1, 2, or 3 closed triangles; tail nearly always longer than hind foot, terete; feet, fur, eyes, and ears very variable; thumb never with a well-developed ligulate nail. (*G. S. Miller, jr.*)

Subgenus MICROTUS Schrank (1798).

Microtus SCHRANK, Fauna Boica, I, Pt. 1, 1798, p. 72.—MILLER, N. Am. Fauna, No. 12 July 23, 1896, p. 63 (subgenus).

Palate normal; m_3 without closed triangles; m_1 normally with 5 closed triangles and 9 salient angles; m^3 normally with 3 closed triangles and 7 or 8 salient angles; mammæ, 8; plantar tubercles, 6; soles moderately hairy; claws of hind feet longest; fur not specially modified. (*G. S. Miller, jr.*)

MICROTUS CALIFORNICUS (Peale).

CALIFORNIA MEADOW-MOUSE OR VOLE.

Arvicola californica PEALE, U. S. Expl. Exped., VIII, Mam., 1848, p. 46 (original description).

Microtus californicus TROUESSART, Catal. Mam., Pt. 3, 1897, p. 563.—ELLIOT, Field Col. Mus., Zool. Ser., II, 1901 (Synop. Mam. N. Am.).—BAILEY, North American Fauna, No. 17, June 6, 1900, p. 34, fig. 3 (teeth).—MILLER and REHN, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 120 (Syst. Results Study N. Am. Mam. to close of 1900).

Type-locality.—Vicinity of San Francisco Bay, California.

Geographical range.—Grassy meadow-lands of the Sonoran (mostly Upper Sonoran) Zone of southern California and northern Lower California.[a]

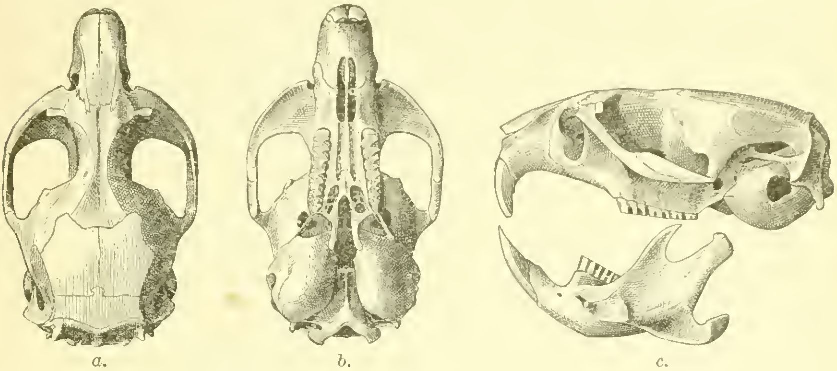

FIG. 125.—MICROTUS CALIFORNICUS. SKULL. *a*, DORSAL VIEW; *b*, VENTRAL VIEW; *c*, LATERAL VIEW.

Description.—Size, large; mammæ, P.$\frac{2}{2}$, A$\frac{0}{0}$, I.$\frac{2}{2}$=4 pairs; skull (fig. 125) massive with rostral portion short and depressed; teeth as shown in fig. 126; coloration similar to *Microtus edax;* pelage full, long, and rather soft; plantar tubercles, 6.

Color.—Upper parts bistre enlivened by tawny and black hairs, shading to grayish drab on sides and rump; under parts plumbeous, overlaid by hoary tips to the hairs; tail not distinctly bicolor, but dusky above and grayish below; feet smoke gray; whiskers mixed brown and white or colorless; head without white or yellowish markings.

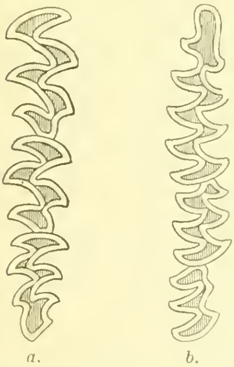

FIG. 126.—MICROTUS CALIFORNICUS. CROWNS OF MOLAR TEETH. *a*, UPPER SERIES; *b*, LOWER SERIES.

Measurements.—(Adult male, Cat. No. 60954 U.S.N.M., from Tecate River, near Tecate Mountain, northern Lower California, June 26, 1894; collected by the author).—Total length, 192 mm.; tail vertebræ, 59; terminal pencil, 6.5; hind foot, 24; ear, from crown, 12.5. Skull, greatest length, 30; zygomatic breadth, 17.3; mastoid breadth, 14; length of nasals, 8.8; alveolar length of upper tooth row, 7.7.

Habits.—When we made our camp on the Tecate River at the foot of Tecate Mountain, in northern Lower California, June 24, 1894, we immediately discovered numerous runways of this, the only species of vole collected on the

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[a] Elliot has described a subspecies *hyperythrus* (in Field Col. Mus., Zool. Ser., III, 1903, p. 161; also in "Land and Sea Mammals of Middle America and the West Indies, Zool. Ser. IV, 1904, pp. 300–303, fig. "51" [skull and teeth], fig. "XLV" [animal]), from San Quentin, Lower California.

Mexican Boundary. Everywhere in the shade of rank growths of cat-tail, sedge, and rush, beside the stream, we could see their much-trodden paths; but the little beasts were so difficult to trap that we only obtained three of them, all caught in daytime. A female taken by Mr. Holzner on June 27 contained four fetuses.

Note.—The following species of voles are slightly extralimital, not being known to occur south of the Southern Pacific Railroad:

MICROTUS MONTANUS ARIZONENSIS Bailey.

ARIZONA MEADOW-MOUSE OR VOLE.

Microtus montanus arizonensis Bailey, Proc. Biol. Soc. Washington, XII, p. 88, Apr. 30, 1898 (original description); North American Fauna, No. 17, June 6, 1900.—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX., No. 1, Dec. 27, 1901, p. 119 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Microtus montanus*] *arizonensis*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 184 (Synop. Mam. N. Am.).

Type-locality.—Springerville, Apache County, Arizona.

MICROTUS ALTICOLA (Merriam).

SAN FRANCISCO MOUNTAIN VOLE.

Arvicola (*Mynomes*) *alticolus* Merriam, North American Fauna, No. 3, Sept. 11, 1890, pl. v, figs. 1 and 2; pl. vi, figs. 1–4 (original description).

Microtus alticolus, Allen, Bull. Am. Mus. Nat. Hist., VII, p. 219, June 29, 1895.—Bailey, North American Fauna, No. 17, June 6, 1900, p. 52 (Revision of American Voles of the genus Microtus).

Microtus alticola, Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 123 (Syst. Results Study N. Am. Mam. to close of 1900).—Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 192 (Synop. Mam. N. Am.).

Type-locality.—Little Spring, San Francisco Mountain, Coconino County, Arizona. Altitude, 8,200 feet.

MICROTUS ALTICOLA LEUCOPHÆUS (Allen).

GRAHAM MOUNTAIN VOLE.

Arvicola leucophæus Allen, Bull. Am. Mus. Nat. Hist., VI, Nov. 7, 1894, p. 320 (original description).

Microtus alticolus leucophæus, Bailey, North American Fauna, No. 17, June 6, 1900, p. 53 (Revision of American Voles of the genus Microtus).

Microtus alticola leucophæus, Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Microtus alticola*] *leucophæus*, Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 192 (Synop. Mam. N. Am.).

Type-locality.—Graham Mountains, Graham County, Arizona.

(MICROTUS MOGOLLONENSIS (Mearns).

MOGOLLON MOUNTAIN VOLE.

Arvicola mogollonensis Mearns, Bull. Am. Mus. Nat. Hist., II, Feb. 21, 1890, p. 283 (original description).

M[icrotus] mogollonensis Miller, Proc. Biol. Soc. Washington, XI, p. 68, Apr. 21, 1890.

Microtus mogollonensis Bailey, North American Fauna, No. 17, June 6, 1900, p. 56 (Revision of American Voles of the genus Microtus).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXX, No. 1, Dec. 27, 1901, p. 123 (Syst. Results Study N. Am. Mam. to close of 1900).

[*Microtus*] *mogollonensis* Elliot, Field Col. Mus., Zool. Ser., II, 1901, p. 192 (Synop. Mam. N. Am.).

Type-locality.—Bakers Butte, Mogollon Mountains, Yavapa County, Arizona. Altitude, 8,000 feet.

MICROTUS MEXICANUS GUADALUPENSIS Bailey.

GUADALUPE MOUNTAIN VOLE.

Microtus mexicanus guadalupensis Bailey, Proc. Biol. Soc. Washington, XV, p. 118, June 2, 1902 (original description).—Miller and Rehn, Proc. Bost. Soc. Nat. Hist., XXXI, Aug. 27, 1903, p. 91 (Syst. Results Study N. Am. Land Mam. during the years 1901 and 1902).

Type-locality.—Guadalupe Mountains, El Paso County, Texas. Altitude, 7,800 feet.

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